Section 11001

Miscellaneous Equipment

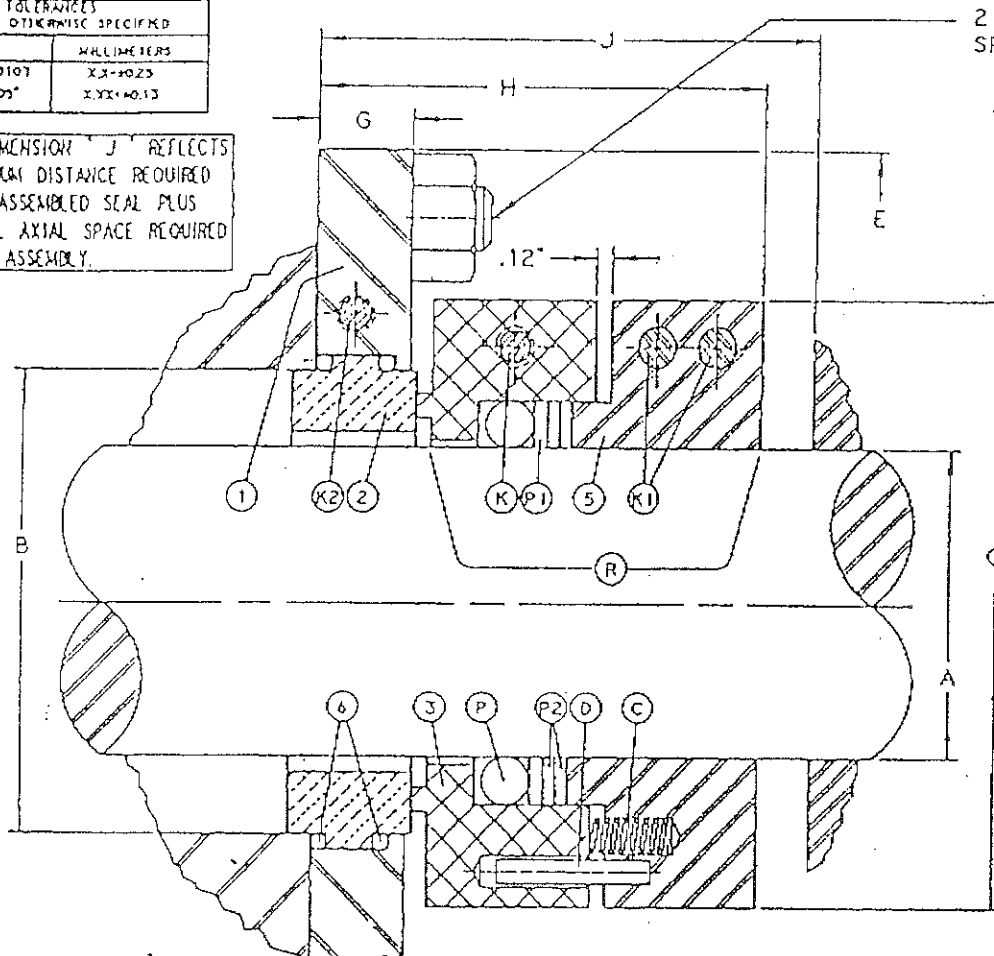**2 - D Ø STUDS EQ.**
SPACED ON F B.C.

TOLERANCES
UNLESS OTHERWISE SPECIFIED

INCHES	MILLIMETERS
X.XX = ±.01 (.010)	X.X = ±0.25
X.XXX = ±.005	X.XX = ±0.13

NOTE : DIMENSION "J" REFLECTS THE MINIMUM DISTANCE REQUIRED FOR THE ASSEMBLED SEAL PLUS ADDITIONAL AXIAL SPACE REQUIRED FOR SEAL ASSEMBLY.

.12"

A ±.001"	B	C	D MIN.	E MIN.	F MIN.	G	H	J MIN.
1.000	2.250	3.38	.500	5.75	4.75	.75	3.44	4.44
1.125	2.375	3.50	.500	5.88	4.88	.75	3.44	4.44
1.250	2.500	3.62	.500	6.00	5.00	.75	3.44	4.44
1.375	2.625	3.75	.500	6.12	5.12	.75	3.44	4.44
1.500	2.750	3.88	.500	6.25	5.25	.75	3.44	4.44
1.625	2.875	4.00	.500	6.38	5.38	.75	3.44	4.44
1.750	3.000	4.12	.500	6.50	5.50	.75	3.44	4.44
1.875	3.125	4.25	.500	6.62	5.62	.75	3.44	4.44
2.000	3.250	4.38	.500	6.75	5.75	.75	3.44	4.44
2.125	3.375	4.50	.500	6.88	5.88	.75	3.44	4.44
2.250	3.500	4.62	.500	7.00	6.00	.75	3.44	4.44
2.375	3.625	4.75	.500	7.12	6.12	.75	3.44	4.44
2.500	3.750	4.88	.500	7.25	6.25	.75	3.44	4.44
2.625	3.875	5.00	.500	7.38	6.38	.75	3.44	4.44
2.750	4.000	5.12	.500	7.50	6.50	.75	3.44	4.44
2.875	4.125	5.25	.500	7.62	6.62	.75	3.44	4.44
3.000	4.250	5.38	.500	7.75	6.75	.75	3.44	4.44
3.125	4.375	5.50	.500	7.88	6.88	.75	3.44	4.44
3.250	4.500	5.62	.500	8.00	7.00	.75	3.44	4.44
3.375	4.625	5.75	.500	8.12	7.12	.75	3.44	4.44
3.500	4.750	5.88	.500	8.25	7.25	.75	3.44	4.44
3.625	4.875	6.00	.500	8.38	7.38	.75	3.44	4.44
3.750	5.000	6.12	.500	8.50	7.50	.75	3.44	4.44
3.875	5.125	6.25	.500	8.62	7.62	.75	3.44	4.44
4.000	5.250	6.38	.500	8.75	7.75	.75	3.44	4.44
4.125	5.375	6.50	.500	8.88	7.88	.75	3.44	4.44
4.250	5.500	6.62	.500	9.00	8.00	.75	3.44	4.44
4.375	5.625	6.75	.500	9.12	8.12	.75	3.44	4.44
4.500	5.750	6.88	.500	9.25	8.25	.75	3.44	4.44
4.625	5.875	7.00	.500	9.38	8.38	.75	3.44	4.44
4.750	6.000	7.12	.500	9.50	8.50	.75	3.44	4.44
4.875	6.250	7.25	.500	9.62	8.62	.75	3.44	4.44

R	ROTARY UNIT CONSISTING OF:		1	GLAND RING
3	SEAL RING		2	INSERT
5	COLLAR		6	O - RINGS
C	SPRINGS		K2	SHOULDER SCREWS
D	DRIVE PINS		P	SHAFT PACKING
K1	SHOULDER SCREWS		P1	BACKUP RING
K	CAP SCREWS		P2	BACKUP RING

RECOMMENDED SPARE PARTS : 3, C, P, P1, P2, 2, 6

MSS
# DURA SEALS
(WITH CLAMP STYLE COLLAR AND PILOTING INSERT)

DURAMETALLIC CORPORATION
KALAMAZOO, MICH.

DATE: 3-30-88	SCALE: H.T.S.
DRAWN: KLH	SHEET 1 OF 2
TRACED:	DRAWING NO.
CHECKED:	2D-24263-1
FORM:	

TOLERANCES
UNLESS OTHERWISE SPECIFIED

INCHES	MILLIMETERS
X.XX = ±.01 (.010)	X.X = ±0.25
X.XXX = ±.005	X.XX = ±0.13

NOTE: DIMENSION "J" REFLECTS THE MINIMUM DISTANCE REQUIRED FOR THE ASSEMBLED SEAL PLUS ADDITIONAL AXIAL SPACE REQUIRED FOR SEAL ASSEMBLY.
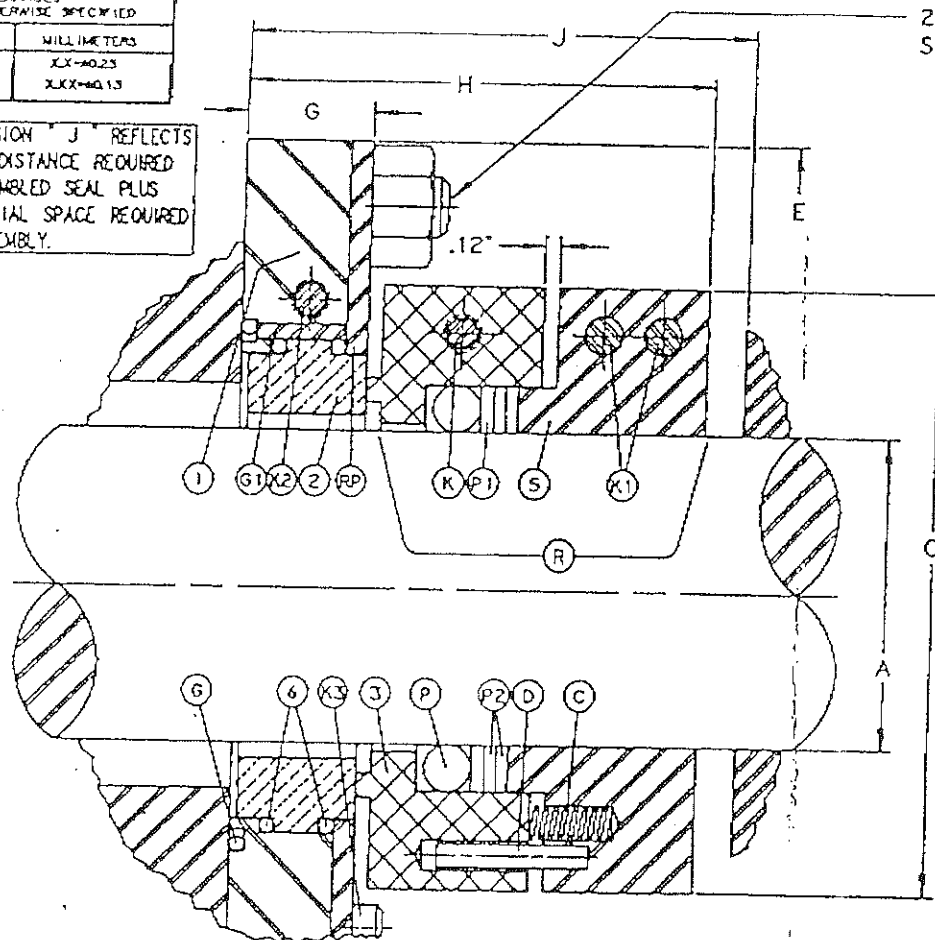
2 - D ∅ STUDS EQ.
SPACED ON F B.C.

NO.	DATE	REVISION
	2-3-61	ADDED GASKET PART 81

A ±.001"	C	D MIN.	E MIN.	F MIN.	G	H	J MIN.
1.000	3.38	.500	5.75	4.75	1.06	3.69	4.69
1.125	3.50	.500	5.88	4.88	1.06	3.69	4.69
1.250	3.62	.500	6.00	5.00	1.06	3.69	4.69
1.375	3.75	.500	6.12	5.12	1.06	3.69	4.69
1.500	3.88	.500	6.25	5.25	1.06	3.69	4.69
1.625	4.00	.500	6.38	5.38	1.06	3.69	4.69
1.750	4.12	.500	6.50	5.50	1.06	3.69	4.69
1.875	4.25	.500	6.62	5.62	1.06	3.69	4.69
2.000	4.38	.500	6.75	5.75	1.06	3.69	4.69
2.125	4.50	.500	6.88	5.88	1.06	3.69	4.69
2.250	4.62	.500	7.00	6.00	1.06	3.69	4.69
2.375	4.75	.500	7.12	6.12	1.06	3.69	4.69
2.500	4.88	.500	7.25	6.25	1.06	3.69	4.69
2.625	5.00	.500	7.38	6.38	1.06	3.69	4.69
2.750	5.12	.500	7.50	6.50	1.06	3.69	4.69
2.875	5.25	.500	7.62	6.62	1.06	3.69	4.69
3.000	5.38	.500	7.75	6.75	1.06	3.69	4.69
3.125	5.50	.500	7.88	6.88	1.06	3.69	4.69
3.250	5.62	.500	8.00	7.00	1.06	3.69	4.69
3.375	5.75	.500	8.12	7.12	1.06	3.69	4.69
3.500	5.88	.500	8.25	7.25	1.06	3.69	4.69
3.625	6.00	.500	8.38	7.38	1.06	3.69	4.69
3.750	6.12	.500	8.50	7.50	1.06	3.69	4.69
3.875	6.25	.500	8.62	7.62	1.06	3.69	4.69
4.000	6.38	.500	8.75	7.75	1.06	3.69	4.69
4.125	6.50	.500	8.88	7.88	1.06	3.69	4.69
4.250	6.62	.500	9.00	8.00	1.06	3.69	4.69
4.375	6.75	.500	9.12	8.12	1.06	3.69	4.69
4.500	6.88	.500	9.25	8.25	1.06	3.69	4.69
4.625	7.00	.500	9.38	8.38	1.06	3.69	4.69
4.750	7.12	.500	9.50	8.50	1.06	3.69	4.69
4.875	7.25	.500	9.62	8.62	1.06	3.69	4.69

R	ROTARY UNIT CONSISTING OF:	6	O - RINGS
3	SEAL RING	G	GASKET
5	COLLAR	G1	GASKETS
C	SPRINGS	K2	SHOULDER SCREWS
D	DRIVE PINS	K3	CAP SCREWS
K1	SHOULDER SCREWS	P	SHAFT PACKING
K	CAP SCREWS	P1	BACKUP RING
1	GLAND RING	P2	BACKUP RING
2	INSERT	RP	RETAINING PLATE

RECOMMENDED SPARE PARTS: 3, C, P, P1, P2, 2 & G, G1

MSS
DURA SEALS
(WITH CLAMP STYLE COLLAR AND NONPLOTING INSERT)

DURAMETALLIC CORPORATION
KALAMAZOO, MICH.

DATE:	3-30-88	SCALE:	N.T.S.
DRAWN:	KLH		
TRACED:		SHEET 1 OF 2
CHECKED:		DRAWING NO.
FORM:		2D-242633-R1

Tapered Roller Bearing Flange Blocks

NON-EXPANSION TYPE

MODEL EFB4

Shaft Size	DIMENSIONS									Wt. Lbs.
	A	B	C	D	E	F Bolt	H	J	L	
1 3/16, 1 1/4	2 13/16	3 3/4	2 11/32	2 7/8	1/16	3/8	1	2 15/16	2 1/4	4.4
1 3/8, 1 7/16	3 1/16	4 5/8	2 19/32	3 1/2	1/16	1/2	1 1/16	3 1/2	2 3/4	6.8
1 1/2, 1 5/8, 1 11/16	3 1/2	5 3/8	2 31/32	4 1/8	1/8	1/2	1 3/16	4 3/16	3 3/16	11.1
1 3/4, 1 7/8, 1 15/16, 2	3 5/8	5 5/8	3 3/32	4 3/8	1/8	1/2	1 3/16	4 7/16	3 7/16	11.7
2 3/16	3 7/8	6 1/4	3 9/32	4 7/8	1/8	5/8	1 3/8	4 7/8	3 3/4	15.5
2 1/4, 2 7/16, 2 1/2	4 3/16	6 7/8	3 9/16	5 3/8	3/16	5/8	1 1/2	5 5/16	4 1/16	20.6
2 11/16, 2 3/4, 2 15/16, 3	4 11/16	7 3/4	3 15/16	6	3/16	3/4	1 5/8	6	4 23/32	26.9
3 3/16, 3 1/4†, 3 7/16, 3 1/2	5 1/4	9 1/4	4 1/4	7	1/4	3/4	1 7/8	7 1/4	5 7/16	51.3
3 15/16, 4	6 1/2	10 1/4	5 5/8	7 3/4	1/4	7/8	2 1/8	8 1/4	5 15/16	75.1

†Assembled to order. Consult factory for delivery.

Tapered Roller Bearing Flange Cartridges　　　Type E

NON-EXPANSION TYPE
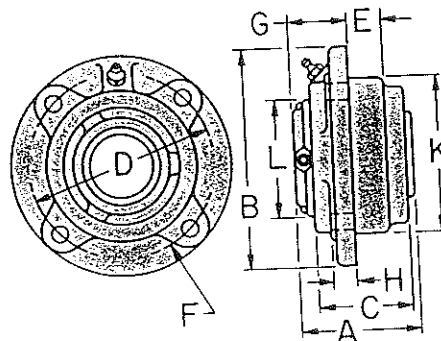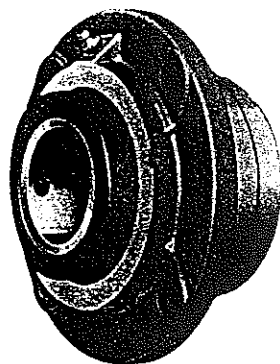
MODELS EFC4 AND EFC6

Shaft Size	DIMENSIONS								K +.000 -.002	L	Wt. Lbs.
	A	B	C	D	E	F Bolt □	G	H			
1 3/16, 1 1/4	2 3/4	5	2 7/32	4 1/8	3/4	3/8	1 9/16	7/16	3 3/8	2 1/4	5.1
1 3/8, 1 7/16	3	5 1/4	2 15/32	4 3/8	7/8	3/8	1 1/2	1/2	3 3/8	2 3/4	6.4
1 1/2, 1 5/8, 1 11/16	3 3/8	6 1/8	2 25/32	5 1/8	1 1/16	7/16	1 9/16	1/2	4 1/4	3 3/16	9.4
1 3/4, 1 7/8, 1 15/16, 2	3 1/2	6 3/8	2 29/32	5 3/8	1 3/16	7/16	1 9/16	9/16	4 1/2	3 7/16	10.6
2 3/16	3 3/4	7 1/8	3 3/32	6	1 3/16	1/2	1 11/16	9/16	5	3 3/4	13.6
2 1/4, 2 7/16, 2 1/2	4	7 5/8	3 9/16	6 1/2	1 5/16	1/2	1 13/16	5/8	5 1/2	4 1/16	17.3
2 11/16, 2 3/4, 2 15/16, 3	4 1/2	8 3/4	3 11/16	7 1/2	1 1/2	5/8	2	3/4	6 3/8	4 23/32	25.8
3 3/16†, 3 1/4, 3 7/16, 3 1/2†	5	10 1/4	4 1/4	8 5/8	1 1/4	3/4	2 7/16	7/8	7 3/8	5 7/16	42.8
3 15/16, 4†	6 1/4	10 7/8	4 1/2	9 3/8	1 1/2	3/4	2 11/16	15/16	8 5/8	5 15/16	57.4
4 3/16, 4 1/2†	6 3/4	13 1/2	4 5/8	11 3/4	1 1/2	3/4‡	3 1/32	1	10 1/4	6 7/16	92.5
4 15/16, 5†	7 1/4	14 3/4	5 1/16	12 3/4	1 3/4	7/8‡	2 23/32	1 1/4	11	7 1/2	122

† Assembled to order. Consult factory for delivery.
□ 4 equally spaced unless otherwise noted.
‡ 6 equally spaced.

Note: Sizes 1 3/16-3 1/2 use single locking collar as shown in drawing.

Heavy Service — For heavy shock loads, frequent shock loads, or severe vibrations, add up to 50% (according to severity of conditions) to the Equivalent Radial Load to obtain a Modified Equivalent Radial Load. Consult customer service for additional selection assistance.

Select a bearing from the rating table having a radial load rating at the operating speed equal to or greater than the calculated "Equivalent Radial Load" for a desired L10 Life. This simple method is all that is required for the majority of general machine applications and provides for occasional average shock loads.

To determine the L10 Hours Life for loads and speeds not listed, use the following equation:

$$L10 = \left(\frac{C90}{P}\right)^{10/3} \times \frac{1,500,000}{RPM}$$

Where: C90 = Dynamic Capacity (Table 1)
         P = Equivalent Radial Load, Lbs.

When the load on a two row roller bearing is solely a radial load with no thrust load, the load is shared equally by both rows of rollers and the equivalent radial load (P) is equal to the actual radial load. However, when a thrust load is applied, the loading on the two rows is shared unequally depending on the ratio of thrust to radial load. The use of the X (radial factor) and Y (thrust factor) from Table 1 convert the actual applied loads to an equivalent radial

load having the same affect on the life of a bearing as a radial load of this magnitude.

The equivalent radial load $P = X\,Fr + Y\,Fa$

If calculated value of P is less than Fr, then use P = Fr

Where P = Equivalent radial load, lbs.

Fr = Radial Load, lbs.

Fa = Thrust (axial) load, lbs.

e = Thrust load to radial load factor (Table 1 below)

X = Radial load factor (Table 1 below)

Y = Thrust load factor (Table 1 below)

To find X and Y, first calculate Fa/Fr and compare to e. Determine X and Y from Table 1: Light thrust if Fa/Fr is less than or equal to e or heavy thrust if Fa/Fr is greater than e.

Substitute all known values into the equivalent radial load equation. P (equivalent radial load) thus determined can be used in life formula to determine L10 or compared to allowable equivalent radial load ratings for the speed and hours life desired in rating table.

L10 Hours Life — Is the life which may be expected from at least 90% of a given group of bearings operating under identical conditions.

TABLE 1

Shaft Size	e	Light Thrust II Fa/Fr ≤ e		Heavy Thrust II Fa/Fr ≥ e		Dynamic Capacity C90*		Maximum RPM	Maximum Slip Fit Radial Load Fr
		X	Y	X	Y	Lbs.	Newtons		
1³⁄₁₆-1¼	.49	.87	1.77	.70	2.14	2,980	13,260	4,490	5,600
1³⁄₈-1⁷⁄₁₆	.46	.87	1.89	.70	2.28	4,760	21,180	3,820	5,600
1½-1¹¹⁄₁₆	.44	.87	1.96	.70	2.37	6,140	27,320	3,320	5,600
1¾-2	.33	.87	2.64	.70	3.18	8,070	35,908	3,050	8,210
2³⁄₁₆	.36	.87	2.38	.70	2.87	8,550	38,044	2,730	8,210
2¼-2½	.40	.87	2.17	.70	2.63	9,090	40,447	2,420	8,210
2¹¹⁄₁₆-3	.46	.87	1.87	.70	2.26	9,600	42,716	2,060	13,800
3³⁄₁₆-3½	.50	.87	1.71	.70	2.07	15,300	68,078	1,640	13,800
3¹⁵⁄₁₆-4	.49	.87	1.77	.70	2.14	21,000	93,440	1,530	22,000
4⁷⁄₁₆-4½	.53	.87	1.63	.70	1.97	25,800	114,799	1,360	32,500
4¹⁵⁄₁₆-5	.47	.87	1.83	.70	2.21	35,500	157,959	1,200	32,500
5⁷⁄₁₆-6	.49	.87	1.76	.70	2.12	40,700	181,097	915	53,000
6⁷⁄₁₆-7	.54	.87	1.61	.70	1.95	69,200	307,910	790	100,000

* C90 — Dynamic capacity based on a rated life of 90 million revolutions or 3,000 hours at 500 RPM.
**If load exceeds maximum allowable slip fit radial load, snug to light press fit of shaft is required.

COMPARING SPHERICAL TO TAPER ROLLER BEARING

The dynamic capacity C (spherical) and C90 (taper) are not to the same base. To compare basic dynamic capacities, multiply C × .259 and compare to C90. To select and then compare, use the complete selection procedure for each type bearing and then compare.

Type B Tapered Roller Bearing Units — Ratings

| Shaft Size	L10 Life Hours	Allowable Equivalent Radial Load Rating (Lbs.) at Various Revolutions Per Minute															
		10	25	50	100	150	250	500	750	1000	1250	1500	1750	2000	2500	3000	3500
1 3/16 1 1/4	5,000	8270	6280	5100	4145	3670	3145	2555	2265	2075	1940	1840	1755	1685	1575	1495	1425
	10,000	6720	5100	4145	3365	2980	2555	2075	1840	1685	1575	1495	1425	1370	1280	1215	1160
	30,000	4830	3670	2980	2420	2145	1840	1495	1320	1215	1135	1075	1025	985	920	870	835
	50,000	4140	3150	2555	2075	1840	1575	1280	1135	1040	975	920	880	845	790	750	715
	100,000	3360	2550	2075	1685	1495	1280	1040	920	845	790	750	715	685	640	610	580
1 3/8 1 7/16	5,000	13210	10030	8150	6620	5860	5025	4085	3615	3315	3100	2935	2805	2695	2520	2385	2275
	10,000	10730	8150	6620	5375	4760	4085	3315	2935	2695	2520	2385	2275	2190	2045	1935	1850
	30,000	7710	5860	4760	3865	3425	2935	2385	2110	1935	1810	1715	1640	1575	1470	1395	1330
	50,000	6620	5030	4085	3315	2935	2520	2045	1810	1660	1555	1470	1405	1350	1260	1195	1140
	100,000	5370	4080	3315	2695	2385	2045	1660	1470	1350	1260	1195	1140	1095	1025	970	925
1 1/2 1 5/8 1 11/16	5,000	17030	12940	10510	8535	7560	6485	5265	4665	4280	4000	3790	3615	3475	3250	3075	
	10,000	13830	10510	8535	6935	6140	5265	4280	3790	3475	3250	3075	2940	2820	2640	2500	
	30,000	9950	7560	6140	4985	4415	3790	3075	2725	2500	2335	2215	2115	2030	1900	1795	
	50,000	8530	6480	5265	4280	3790	3250	2640	2335	2145	2005	1900	1810	1740	1630	1540	
	100,000	6940	5270	4280	3475	3075	2640	2145	1900	1740	1630	1540	1470	1415	1325	1250	
1 3/4 1 7/8 1 15/16 2	5,000	22390	17010	13815	11220	9935	8525	6925	6130	5625	5260	4980	4755	4565	4270	4045	
	10,000	18180	13810	11220	9115	8070	6925	5625	4980	4565	4270	4045	3860	3710	3470	3285	
	30,000	13080	9940	8070	6555	5805	4980	4045	3580	3285	3070	2910	2775	2670	2495	2360	
	50,000	11220	8530	6925	5625	4980	4270	3470	3070	2820	2635	2495	2380	2290	2140	2025	
	100,000	9120	6930	5625	4565	4045	3470	2820	2495	2290	2140	2025	1935	1860	1740	1645	
2 3/16	5,000	23720	18020	14635	11885	10525	9030	7335	6495	5960	5570	5275	5035	4840	4525		
	10,000	19260	14630	11885	9655	8550	7335	5960	5275	4840	4525	4285	4090	3930	3675		
	30,000	13860	10530	8550	6945	6150	5275	4285	3795	3480	3255	3080	2940	2825	2656		
	50,000	11890	9030	7335	5960	5275	4525	3675	3255	2985	2790	2645	2525	2425	2270		
	100,000	9660	7340	5960	4840	4285	3675	2985	2645	2425	2270	2145	2050	1970	1840		
2 1/4 2 5/16 2 1/2	5,000	25220	19160	15560	12640	11190	9600	7800	6905	6335	5925	5610	5355	5145	4810		
	10,000	20490	15560	12640	10265	9090	7800	6335	5610	5145	4810	4555	4350	4180	3910		
	30,000	14730	11190	9090	7385	6535	5610	4555	4035	3700	3460	3275	3130	3005	2810		
	50,000	12640	9600	7800	6335	5610	4810	3910	3460	3175	2970	2810	2685	2580	2410		
	100,000	10270	7800	6335	5145	4555	3910	3175	2810	2580	2410	2285	2180	2095	1960		
2 11/16 2 3/4 2 15/16 3	5,000	26630	20230	16430	13345	11820	10140	8235	7290	6690	6255	5925	5655	5435			
	10,000	21630	16430	13345	10840	9600	8235	6690	5925	5435	5080	4810	4595	4415			
	30,000	15580	11820	9600	7795	6905	5925	4810	4260	3910	3655	3460	3305	3175			
	50,000	13350	10140	8235	6690	5925	5080	4125	3655	3350	3135	2970	2835	2725			
	100,000	10840	8240	6690	5435	4810	4125	3350	2970	2725	2545	2410	2300	2210			
3 3/16 3 1/4 3 7/16 3 1/2	5,000	42440	32240	26190	21270	18835	16160	13125	11620	10660	9970	9440					
	10,000	34470	26190	21270	17280	15300	13125	10660	9440	8660	8100	7670					
	30,000	24800	18840	15300	12425	11005	9440	7670	6790	6230	5825	5515					
	50,000	21270	16160	13125	10660	9440	8100	6580	5825	5345	4995	4730					
	100,000	17280	13120	10660	8660	7670	6580	5345	4730	4340	4060	3845					
3 15/16 4	5,000	58250	44250	35945	29200	25855	22180	18015	15950	14635	13685	12955					
	10,000	47320	35950	29200	23715	21000	18015	14635	12955	11885	11115	10525					
	30,000	34030	25850	21000	17055	15105	12955	10525	9320	8550	7995	7570					
	50,000	29200	22180	18015	14635	12955	11115	9030	7995	7335	6860	6495					
	100,000	23720	18020	14635	11885	10525	9030	7335	6495	5955	5570	5275					
4 7/16 4 1/2	5,000	71580	54370	44165	35870	31765	27250	22135	19600	17980							
	10,000	58130	44160	35870	29135	25800	22135	17980	15920	14605							
	30,000	41810	31760	25800	20955	18555	15920	12930	11450	10500							
	50,000	35870	27250	22135	17980	15920	13655	11095	9820	9010							
	100,000	29140	22140	17980	14605	12930	11095	9010	7980	7320							
4 15/16 5	5,000	98480	74810	60765	49360	43705	37495	30455	26965	24740							
	10,000	80000	60770	49360	40090	35500	30455	24740	21905	20095							
	30,000	57530	43710	35500	28835	25530	21905	17790	15755	14450							
	50,000	49360	37490	30455	24740	21905	18790	15265	13515	12400							
	100,000	40100	30460	24740	20095	17790	15265	12400	10980	10070							
5 7/16 5 15/16 6	5,000	112910	85770	69670	56590	50105	42990	34915	30920								
	10,000	91710	69670	56590	45965	40700	34915	28360	25115								
	30,000	65960	50110	40700	33060	29270	25115	20400	18060								
	50,000	56590	42990	34915	28360	25115	21545	17500	15495								
	100,000	45960	34920	28360	23035	20400	17500	14215	12585								
6 7/16 6 1/2 6 15/16 7	5,000	191970	145840	118455	96215	85195	73090	59365	52570								
	10,000	155930	118450	96215	78150	69200	59365	48220	42700								
	30,000	112150	85200	69200	56205	49770	42700	34680	30710								
	50,000	96210	73090	59365	48220	42700	36630	29755	25345								
	100,000	78150	59370	48220	39170	34680	29755	24170	21400								

Note: Ratings shown are ratings of the bearing only. Maximum radial or thrust load may be limited by housing strength or other components. Refer to pages K-40 through K-42. Refer to Table 1, page K-42 for maximum RPM and maximum slip fit radial load.
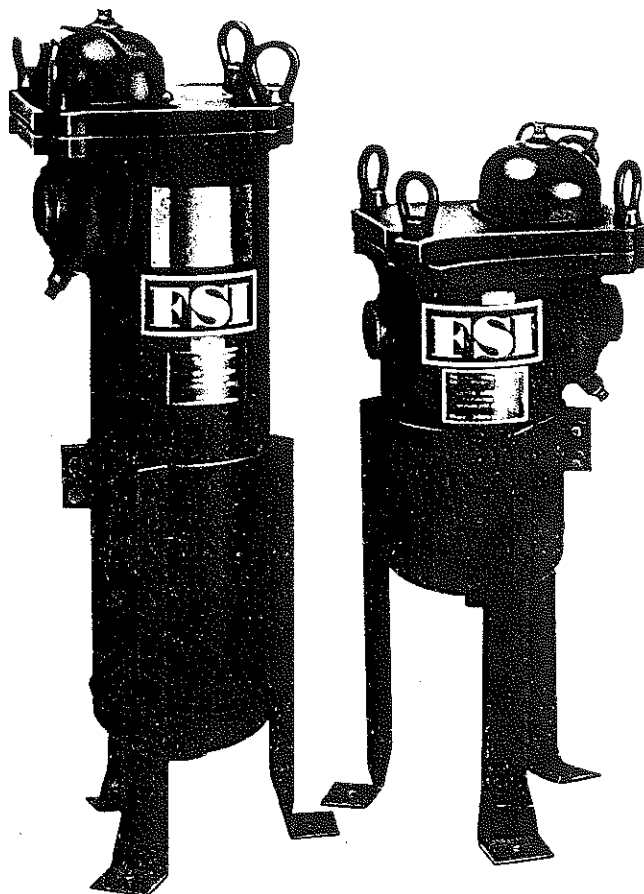
Model FSP-85 Style 1   **Model FSP-40 Style 4**

MODEL FSP-40

Features up to 4" full port that permits non-restricted flow. **Straight in-line design available.** Makes manifolding easy. New basket design eliminates need for gaskets. Designed for continuous flow up to 100 GPM and small-batch operations. Requires one size #1 filter bag.

MODEL FSP-85

Features up to 4" full port that permits unrestricted flow. **Straight in-line design available.** Makes manifolding easy. New basket design eliminates need for gaskets. Designed for continuous flow up to 200 GPM and batch operations where Model FSP-40 does not have the capacity. Requires only one size #2 filter bag.

STYLES

The new models FSP-40 and FSP-85 are available in styles shown on the opposite side of this page.

TYPICAL APPLICATIONS

Typical applications for both the FSP-40 and FSP-85 include paints, chemicals, inks, coatings, resins, solvents and adhesives.

FILTER BAGS VS. CONVENTIONAL CARTRIDGES

Model FSP-40: Performance of the FSP-40 is equal to approximately six to nine (6-9) conventional 10" cartridges.

Model FSP-85: Performance of the FSP-85 is equal to approximately twelve to eighteen (12-18) conventional 10" cartridges.

SPECIFICATIONS

Model No.	No. of Filter Bags	Bag Size No.	Surface area Per bag, ft.^{2}	Surface area per filter, ft^2	Inlet and Outlet Size	Max. flow rate, GPM
FSP-40	1	1	2.0	2.0	1" thru 4"	90
FSP-85	1	2	4.4	4.4	1" thru 4"	200

Maximum flow rate is based on aqueous flow at 1.0 PSI $\triangle$P clean through vessel only without bags installed.

ADDITIONAL FEATURES

- Single gasket seal
- Positive bag sealing
- Easy access for fast cleaning
- Permanent piping
- Heavy-duty baskets (standard)
- New float evacuation system (optional)
- Can be supplied with steam jackets, extra-length legs and corrosion allowance
- Mesh lined baskets available for straining applications
- Data obtained using the FSP-40 or FSP-85 filters can be extrapolated to estimate the performance of larger FSI filters

SPECIFICATIONS

- Standard 2" inlet & outlet
- Specific locations and sizes up to 4" available on request
- 4 standard styles
- Stock vessels available in:
  1. Carbon steel
  2. 304 stainless steel
- 316 stainless steel and electroless nickel plated carbon steel vessels available on request
- Standard 150 or 300 PSI ASME code stamp (meets OSHA requirements) or customer specification
- Filter bags available rated 1 to 1500 microns
- Gasket materials include Buna N, Neoprene, EPR, Viton, Teflon

STYLES

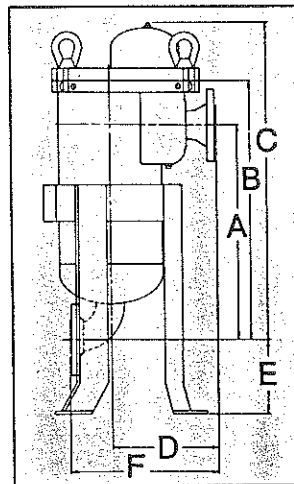Styles one thru four (1-4) are shown below (available for both the FSP-40 and FSP-85).
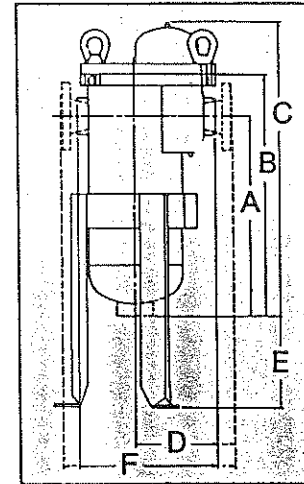Dimensional drawings, styles 1, 2, 3 & 4
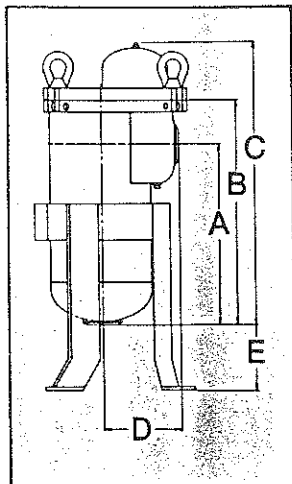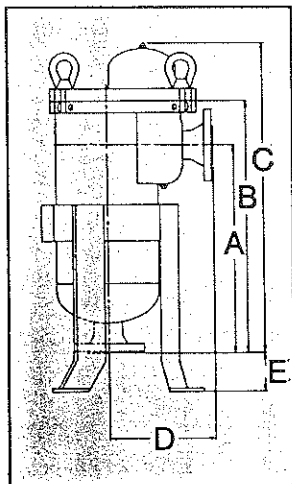
Style 1	Style 2	Style 3	Style 4
(2″ NPT Fittings)	(2″ Flanged Fittings)	(2″ Flanged Fittings with 90° Elbow)	Inline 2″ NPT or Flanged

FSP-40 and FSP-85 dimensions

L NO.	A	B	C	D	E	F
FSP-40-1	13¾″	17⅞″	21½″	7¼″	9¼″ - 12½″	N/A
40-2	15⅜″	19½″	23⅜″	9″	7½″ - 10¾″	N/A
FSP-40-3	15⅛″	19⅛″	23¼″	9″	6½″ - 9¾″	12½″
FSP-40-4 NPT	13¾″	17⅞″	21½″	7¼″	9¼″ - 12½″	13″
FSP-40-4 FLG	13¾″	17⅞″	21½″	9″	7½″ - 10¾″	15¼″
FSP-85-1	26⅜″	30⅞″	34⅛″	7¼″	0 - 12½″	N/A
FSP-85-2	28⅞″	32⅞″	36⅛″	9″	0 - 10¾″	N/A
FSP-85-3	29⅛″	33⅛″	36⅛″	9″	0 - 9¾″	12½″
FSP-85-4 NPT	26⅜″	30⅞″	34⅛″	7¼″	0 - 12½″	13″
FSP-85-4 FLG	26⅜″	30⅞″	34⅛″	9″	0 - 10¾″	15¼″

Dimensions shown are for 2″ fittings.

Filter bag performance data for single-length bags

Pressure Drop (PSI)

Flow rate (GPM) of water at 77° F
Multiply results X 2.2 for #2 size filter bag

5 & 10 MICRON
25 MICRON
50 MICRON
100 MICRON

Filter Vessel Legs   **Heavy-duty restrainer basket**   **Evacuation float (accessory)**
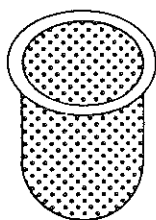
Note 1: For recommendations on which bag or filter housing material to use, and for complete technical data or pressure drop and flow rate — also how to size FSI bag filters — contact your FSI representative or FSI direct.

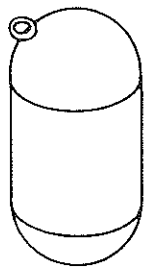Note 2: 2″ NPT drain standard on style 4 vessels.

Note 3: Customer to specify piping size and type connections if different from standard 2″.

FSI filter specialists, inc.

100 Anchor Road
P.O. Box 735
Michigan City, Indiana 46360
219/879-3307

Distributed by:

NEMA FLANGE				B.C. DIA.	COUNTER BORE	MOTOR SHAFT QUILL	KEYWAY	KEY FURN- ISHED
A	B	C	D	E	F	G	H	
56C	2⅜	6½	¹³⁄₃₂	5⅞	4.501 / 4.503	.6255 / .6270	³⁄₁₆ × ³⁄₃₂	³⁄₁₆ Sq.
143TC, 145TC, 182C, 184C	2⅜	6½	¹³⁄₃₂	5⅞	4.501 / 4.503	.8755 / .8770	³⁄₁₆ × ³⁄₃₂	³⁄₁₆ Sq.
182TC, 184TC, 213C, 215C	3³⁄₁₆	9	¹⁷⁄₃₂	7¼	8.501 / 8.504	1.1255 / 1.1270	¼ × ⅛	¼ Sq.
213TC, 215TC	3½	9	¹⁷⁄₃₂	7¼	8.501 / 8.504	1.3755 / 1.3770	⁵⁄₁₆ × ⁵⁄₃₂	⁵⁄₁₆ Sq.

MODELS	
PRIMARY	SECONDARY
454	807

FACTORY ASSEMBLED ONLY.

HUB CITY LUBRICANT RECOMMENDED. (REFER TO PAGE L-20.)

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.
CERTIFIED PRINTS ARE AVAILABLE UPON REQUEST.

DRY SHIPPING WEIGHT 991 LBS.

STANDARD STYLES AVAILABLE

NOTE: ASSEMBLIES, LA-L, LB-L, RA-R, RB-R, ARE NOT AVAILABLE DUE TO INTERFERENCE BETWEEN PRIMARY UNIT C FLANGE AND SECONDARY UNIT SIDE MOUNT FLANGE.

RA   Not Available   LB   UL   LA   UR   RB   Not Available   L   R

STYLE UR — L

INPUT SHAFT CAN BE ROTATED IN EITHER DIRECTION

Series 80D, Ratings

1750 RPM INPUT SPEED (HIGH SPEED SHAFT)

RATIO Output R.P.M.	Ratio Comb. Primary	Ratio Comb. Secondary	1.00 Input H.P.	1.00 Output Torque	1.25 Input H.P.	1.25 Output Torque	1.50 Input H.P.	1.50 Output Torque	1.75 Input H.P.	1.75 Output Torque	Eff. %	Basic Unit Input H.P.	Basic Unit Output Torque	Synthetic Lube Input H.P.	Synthetic Lube Output Torque
100	17.5	10	10	16.3	44908	13.04	35926	10.87	29939	9.31	25662	76.5	7.55	20800	8.68	23920
150	11.7	15	10	12.4	47895	9.92	38316	8.27	31930	7.09	27369	71.5	5.35	20670	6.15	23770
200	8.75	10	20	10.4	52384	8.32	41907	6.93	34923	5.94	29934	69.9	7.55	38010	8.68	43710
300	5.83	15	20	7.87	55295	6.30	44236	5.25	36863	4.50	31597	65.0	5.35	37570	6.15	43210
400	4.38	20	20	6.22	56097	4.98	44878	4.15	37398	3.55	32055	62.6	4.53	40850	5.21	46980
500	3.50	10	50	5.12	51217	4.10	40974	3.41	34145	2.93	29267	55.5	4.36	43590	5.01	50130
600	2.92	15	40	5.00	58451	4.00	46761	3.33	38967	2.86	33401	54.1	5.00	58451	NOT	
750	2.33	15	50	3.81	52325	3.05	41860	2.54	34883	2.18	29900	50.8	3.81	52325	REQUIRED	
1000	1.75	20	50	3.02	52325	2.42	41860	2.01	34883	1.73	29900	48.1	3.02	52325		
1200	1.46	30	40	3.02	56644	2.42	45315	2.01	37763	1.73	32368	43.4	3.02	56644		
1500	1.17	50	30	2.50	55257	2.00	45206	1.67	36838	1.43	31575	40.9	2.30	50820	2.50	55257
1800	.972	60	30	2.21	55257	1.77	45206	1.47	36838	1.26	31575	38.6	2.07	51800	2.21	55257
2000	.875	50	40	2.02	55849	1.62	44679	1.35	37233	1.15	31914	38.3	2.02	55849	NOT	
2400	.729	60	40	1.80	55849	1.44	44679	1.20	37233	1.03	31914	36.0	1.80	55849	REQUIRED	
3000	.583	60	50	1.50	54129	1.20	43303	1.00	36086	.857	30931	33.4	1.50	54129		
3600	.486	60	60	1.04	41905	.832	33524	.693	27937	.594	23946	31.1	1.04	41905		

1150 RPM INPUT SPEED (HIGH SPEED SHAFT)

RATIO Output R.P.M.	Ratio Comb. Primary	Ratio Comb. Secondary	1.00 Input H.P.	1.00 Output Torque	1.25 Input H.P.	1.25 Output Torque	1.50 Input H.P.	1.50 Output Torque	1.75 Input H.P.	1.75 Output Torque	Eff. %	Basic Unit Input H.P.	Basic Unit Output Torque	Synthetic Lube Input H.P.	Synthetic Lube Output Torque
100	11.5	10	10	12.1	50977	9.68	40782	8.07	33985	6.91	29130	76.8	6.18	26010	7.11	29910
150	7.67	15	10	8.70	51730	6.96	41384	5.80	34487	4.97	29560	72.3	4.47	26570	5.14	30560
200	5.75	10	20	7.51	57457	6.01	45966	5.01	38305	4.29	32833	69.8	6.18	47280	7.11	54370
300	3.83	15	20	5.25	56097	4.20	44878	3.50	37398	3.00	32055	65.0	4.47	47770	5.14	54940
400	2.88	20	20	4.08	56097	3.26	44878	2.72	37398	2.33	32055	62.7	3.89	53470	4.08	56097
500	2.30	10	50	3.50	52325	2.80	41860	2.33	34883	2.00	29900	54.6	3.50	52325		
600	1.92	15	40	3.19	55849	2.55	44679	2.13	37233	1.82	31914	53.3	3.19	55849		
750	1.53	15	50	2.56	52325	2.05	41860	1.71	34883	1.46	29900	49.8	2.56	52325		
1000	1.15	20	50	2.02	52325	1.62	41860	1.35	34883	1.15	29900	47.3	2.02	52325	NOT	
1200	.958	30	40	1.95	55849	1.56	44679	1.30	37233	1.11	31914	43.6	1.95	55849	REQUIRED	
1500	.767	50	30	1.63	55257	1.30	44206	1.09	36838	.931	31575	41.3	1.63	55257		
1800	.639	60	30	1.50	57857	1.20	44206	1.00	38571	.857	33061	39.1	1.50	57857		
2000	.575	50	40	1.32	55849	1.06	44679	.880	37233	.754	31914	38.5	1.32	55849		
2400	.479	60	40	1.16	55849	.928	44679	.773	37233	.663	31914	36.5	1.16	55849		
3000	.383	60	50	.944	52325	.755	41860	.629	34883	.539	29900	33.7	.944	52325		
3600	.319	60	60	.676	41905	.541	33524	.451	27937	.386	23946	31.4	.676	41905		

850 RPM INPUT SPEED (HIGH SPEED SHAFT)

RATIO Output R.P.M.	Ratio Comb. Primary	Ratio Comb. Secondary	1.00 Input H.P.	1.00 Output Torque	1.25 Input H.P.	1.25 Output Torque	1.50 Input H.P.	1.50 Output Torque	1.75 Input H.P.	1.75 Output Torque	Eff. %	Basic Unit Input H.P.	Basic Unit Output Torque	Synthetic Lube
100	8.5	10	10	9.11	51730	7.29	41384	6.07	34487	5.21	29560	76.6	5.66	32150	
150	5.67	15	10	6.36	51730	5.09	41384	4.24	34487	3.63	29560	73.1	4.14	33660	
200	4.25	10	20	5.47	56097	4.38	44878	3.65	37398	3.13	32055	69.2	5.47	56097	
300	2.83	15	20	3.90	56097	3.12	44878	2.60	37398	2.23	32055	64.6	3.90	56097	N
400	2.12	20	20	3.04	56097	2.43	44878	2.03	37398	1.74	32055	62.2	3.04	56097	O
500	1.70	10	50	2.65	52325	2.12	41860	1.77	34883	1.51	29900	53.2	2.65	52325	T
600	1.42	15	40	2.40	55849	1.92	44679	1.60	37233	1.37	31914	52.3	2.40	55849	R
750	1.13	15	50	2.01	54323	1.61	43458	1.34	36215	1.15	31042	48.6	2.01	54323	E
1000	.850	20	50	1.52	52325	1.22	41860	1.01	34883	.869	29900	46.5	1.52	52325	Q
1200	.708	30	40	1.50	57523	1.20	46018	1.00	38349	.857	32870	43.1	1.50	57523	U
1500	.567	50	30	1.22	55257	.976	44206	.813	36838	.697	31575	40.9	1.22	55257	I
1800	.472	60	30	1.07	55257	.856	44206	.713	36838	.611	31575	38.6	1.07	55257	R
2000	.425	50	40	.986	55849	.789	44679	.657	37233	.563	31914	38.2	.986	55849	E
2400	.354	60	40	.874	55849	.699	44679	.583	37233	.499	31914	35.9	.874	55849	D
3000	.283	60	50	.706	52325	.565	41860	.471	34883	.403	29900	33.3	.706	52325	
3600	.236	60	60	.508	41905	.406	33524	.339	27937	.290	23946	30.9	.508	41905	

(Synthetic Lube column reads vertically: NOT REQUIRED)

OVERHUNG LOAD-LOW SPEED SHAFT — MODELS 8001 AND 8004 7,000 LBS. AT CENTER POINT OF SHAFT EXTENSION.
MODELS 8007 AND 8008 — OHL* 9,800 LBS., TO* THRUST OUT 8,300 LBS. AND TI* THRUST IN 6,500 LBS.
MODELS 8009 AND 8010 7,000 LBS. AT CENTER POINT OF SHAFT EXTENSION. THRUST* UP OR DOWN 6,500 LBS.

*OHL and Thrust values shown are independent functions and cannot be applied simultaneously. Refer applications with combined OHL and Thrust to Hub City Customer Service Department.
Thermal capacity can be improved on some applications with the addition of a fan on the primary unit. Consult Hub City Customer Service for specifics.
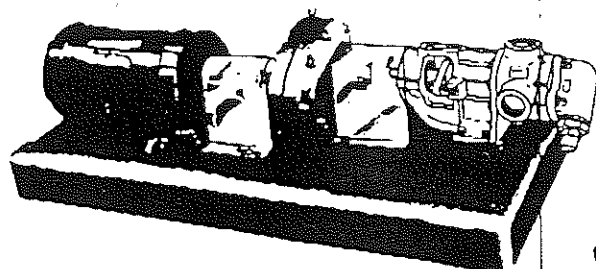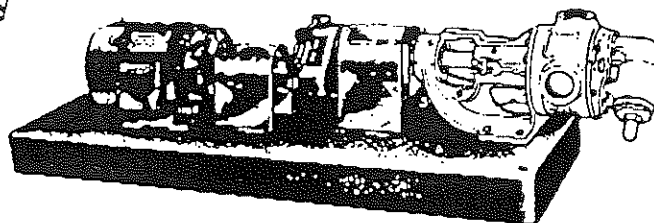
SPATCO

11
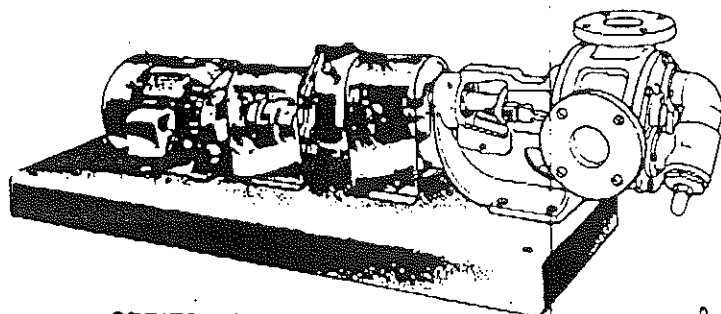
VIKING'S HEAVY-DUTY PUMPS

SERIES 125 AND 4125

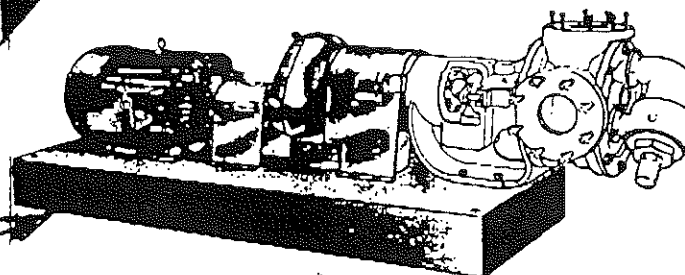## VIKING HELICAL GEAR REDUCTION UNITS ("R" DRIVE)

SERIES 125 and 4125 Pumps
with "R" Drive "A" Reducer

SERIES 125 and 4125 Pumps
with "R" Drive "B" Reducer

SERIES 125 and 4125 Pumps
with "R" Drive "B" Reducer

SERIES 125 and 4125 Pumps
with "R" Drive "C" Reducer

Viking's heavy-duty pump Series 125 and 4125 are available with helical gear reducers that have been specifically developed for efficient operation with Viking heavy-duty pumps. These rugged, compact, exceptionally quiet gear reducers come in three sizes: the "small" A size, "medium" B size and "large" C size.

The "A" size reducer, available with four gear ratios (2.24, 2.76, 3.43 and 4.17 to 1), is ideally suited for use with the "G," "H," "HL," "AK" and "AL" size pumps. This reducer is bracket mounted and requires couplings on both the input and output shafts. With the "A" size reducer and 1200 or 1800 RPM motors, the "G," "H," "HL," "AK" and "AL" size pumps can be used to cover a capacity range from 1.2 to 51 GPM.

The medium size "B" helical gear reducer is available with six gear ratios from 2.76 to 1 to 7.65 to 1. This size normally is used with pump sizes "AK" through "LS." Like the

"A" reducer, the "B" reducer is bracket mounted and requires couplings on both the input and the output shafts. With the "B" reducer, "AK" through "LS" pumps driven by 1200 or 1800 RPM motors can be used to cover a capacity range from 6 to 213 GPM.

The large "C" size reducer also is available with six gear ratios from 2.80 to 1 to 7.95 to 1. It is normally used with the "KK" through "M" size pumps. Like the "A" and "B" reducers, the "C" reducer is bracket mounted and requires flexible couplings both for the input and output shafts. With the "C" reducer, "KK" through "M" size pumps, driven by 1200 or 1800 RPM motors, can cover a capacity range from 15 to 410 GPM.

Dimensions for "R" Drive Units—See Pages 141.12 and 141.13.
Performance Data for "R" Drive Units—See Pages 141.17 through 141.42.

Viking Pump-Houdaille, Inc., A Subsidiary of Houdaille Industries, Inc. - Cedar Falls, Iowa 50613 U.S.A.

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⚑ Greenville, SC (803)299-0135   ⚑ Chattanooga, TN (615)855-1417   ⚑ Knoxville, TN (615)938-7728   ⚑ Nashville, TN (615)350-8080   ⚑

SPATCO   12

VIKING® HEAVY-DUTY PUMPS

SERIES 125 AND 4125

VIKING HELICAL GEAR REDUCTION UNIT ("R" DRIVE)

HELICAL REDUCER SPECIFICATIONS AND PUMP CAPACITY TABLE—"A" SIZE

Motor RPM	Reducer Ratio	① Max. Motor HP	Pump RPM	PUMP MODELS AND CAPACITY GPM② WITH SIZE "A" REDUCER									
				G125R or G4125R		H125R or H4125R		HL125R or HL4125R		AX125R or AX4125R		AL125R or AL4125R	
				50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI
1800	2.24 to 1	5	780	3.7	3.3	6.6	6.3	13.4	13.0	36.5	36.0	51	50
	2.76 to 1	5	640	2.8	2.5	5.3	5.1	10.9	10.5	29.5	29.0	42	41
	3.43 to 1	3	520	2.2	1.8	4.2	3.9	8.6	8.2	23.8	23.3	34	33
	4.17 to 1	3	420	1.7	1.3	3.3	3.0	6.8	6.4	19.2	18.7	27	26
1200	2.24 to 1	3	520	2.2	1.8	4.2	3.9	8.6	8.2	23.8	23.3	34	33
	2.76 to 1	3	420	1.7	1.3	3.3	3.0	6.8	6.4	19.2	18.7	27	26
	3.43 to 1	2	350	1.2	....	2.6	2.3	5.4	5.0	15.3	14.8	23	22
	4.17 to 1	2	280	...	....	2.0	1.7	4.2	3.8	11.0	10.6	18	17

HELICAL REDUCER SPECIFICATIONS AND PUMP CAPACITY TABLE—"B" SIZE

Motor RPM	Reducer Ratio	① Max. Motor HP	Pump RPM	PUMP MODELS AND CAPACITY GPM② WITH SIZE "B" REDUCER												
				AX125R or AX4125R		AL125R or AL4125R		K125R or K4125R		KK125R or KK4125R		L125R, LQ125R, L4125R or LQ4125R		LL125R or LL4125		LS125R or LS4125R	
				50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI	50 PSI	100 PSI
1800	2.76 to 1	15	640	29.5	29.0	42	41	65	64	84	83	144	143	....	....	213	209
	3.40 to 1	10	520	23.8	23.3	34	33	53	52	68	68	117	116	147	146	172	168
	4.19 to 1	10	420	19.2	18.7	27	26	42	41	54	53	94	93	117	116	138	134
	5.06 to 1	10	350	15.3	14.8	23	22	35	34	44	43	77	76	96	95	115	111
	6.27 to 1	7½	280	11.0	10.5	18	17	27	26	34	33	61	60	75	74	90	86
	7.85 to 1	5	230	...	...	...	...	22	21	27	26	50	49	61	60	74	70
1200	2.76 to 1	10	420	19.2	18.7	27	26	42	41	54	53	94	93	117	116	138	134
	3.40 to 1	10	350	15.3	14.8	23	22	35	34	44	43	77	76	96	95	115	111
	4.19 to 1	7½	280	12.0	11.6	18	17	27	26	34	33	61	60	75	74	90	86
	5.06 to 1	7½	230	10.0	9.5	15	14	22	21	27	26	50	49	61	60	74	70
	6.27 to 1	5	190	8.0	7.5	12	11	18	17	22	21	40	39	50	49	59	55
	7.65 to 1	5	155	6.0	5.5	9	8	14	13	17	16	31	30	38	37	47	43

HELICAL REDUCER SPECIFICATIONS AND PUMP CAPACITY TABLE—"C" SIZE

Motor RPM	Reducer Ratio	① Maximum Motor HP	Pump RPM	PUMP MODELS AND CAPACITY GPM② WITH SIZE "C" REDUCER								
				KK125R KK4125R	L125R, LQ125R L4125R or LQ4125R		LL125R or LL4125R		LS125R or LS4125R	G125R or G4125R		M125R or M4125R
				200 PSI	150 PSI	200 PSI	150 PSI	200 PSI	150 PSI	50 PSI	100 PSI	50 PSI	75 PSI
1800	2.80 to 1	40	640	82	142	141	....	....	205	....	....	....	....
	3.31 to 1	40	520	65	115	114	145	143	184	307	302	....	....
	4.21 to 1	30	420	52	92	91	115	113	130	241	236	410	403
	5.08 to 1	25	350	42	75	74	94	92	107	193	188	335	328
	6.24 to 1	20	280	32	58	58	73	71	82	145	140	257	250
	7.95 to 1	15	230	25	48	47	59	57	66	115	110	205	198
1200	2.80 to 1	30	420	52	92	91	115	113	130	241	236	410	403
	3.31 to 1	25	350	42	75	74	94	92	107	193	188	335	328
	4.21 to 1	20	280	32	58	58	73	71	82	146	140	257	250
	5.08 to 1	20	230	25	48	47	59	57	66	115	110	205	198
	6.24 to 1	15	190	15	38	37	48	46	51	89	84	160	153
	7.95 to 1	10	155	15	29	28	36	34	39	64	59	122	115

① Recommended maximum motor horsepower based on 8-10 hour per day service (Service Factor of 1.0). For other time length of service per day, see Service Factor table and Reducer Horsepower tables in General Catalog Section

② Capacities are based on 100 SSU liquid and 15" Mercury Vacuum.

610 or Technical Service Manual (TSM-610) to determine reducer capabilities.

SPATCO

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VIKING® HEAVY-DUTY PUMPS

SERIES 125 AND 4125

UNMOUNTED PUMPS

"AK" and "AL" Sizes

"LQ" and "LL" Sizes

"Q" and "M" Sizes

"LS" Size

"G," "H" and "HL" Sizes

"K," "KK" and "L" Sizes

This series of heavy-duty pumps is available either unmounted or mounted units as shown on following pages. Available with Multi-Ring stuffing box or Buna-N mechanical seal with carbon rotating and Ni-Resist stationary faces. The integral thrust bearing is designed to handle heavy-duty pumping jobs without problems of end play and distortion. For increased versatility of installation and complete selection of ports, the pump casing is designed so it can be rotated on the bracket to any 45° or 90° angle from

that shown in the illustrations. See revolvable casing feature on Page 141.3. Pressure relief valve on head is standard for this series. To permit use of this type pump in a greater range of applications, some sizes are available with jacketed head plate. For heavy-duty pumps with jacketed bracket and head, see Catalog Section 142.
Dimensions for Unmounted Pumps—See Page 141.11.
Performance Data for Unmounted Pumps—See Pages 141.17 through 141.42.

CONSTRUCTION—SERIES 125 AND ①4125 ("G" THROUGH "M" SIZES)

Pump Construction	Casing	Head	Bracket	Rotor	Idler	Rotor Shaft and Idler Pin	Bushings				Internal Relief Valve
							Packed		Mech. Seal		
							Idler	Bracket	Idler	Bracket	
Standard Construction	Iron	Iron	Iron	② Iron	Iron	Steel	Bronze	Bronze	Carbon Graphite	⑧ Bronze	Iron
Steel Fitted	Iron	Iron	Iron	Steel	⑦ Iron	Steel	Bronze	Bronze	Carbon Graphite	⑧ Bronze	Iron
③ Bronze Fitted	Iron	Iron	Iron	⑤ Bronze	Bronze	Steel	Bronze	Bronze	Carbon Graphite	⑧ Bronze	Iron

SPECIFICATIONS—SERIES 125 AND ①4125 UNMOUNTED PUMPS

Model Number		Port Size	① Nominal Pump Rating		Motor HP Required At Rated Speed Pumping 100 SSU Liquid		Maximum Hydro Static Pressure	Steel Fitted Construction Recommended Above This Viscosity	⑩ Max. Rec. Discharge Pressure Handling 100 SSU Liquid At Rated Speeds	① Maximum Recommended Temperature for Catalogued Pump. °F.		Approximate Shipping Weight With Valve
Packed	① ⑨ Mech. Seal	Inches	GPM	RPM	50 PSI	100 PSI	PSIG	SSU	PSIG	Packed	Mech. Seal	Pounds
G125	G4125	1	8	1800	¾	1½	400	7,500	200	300	225	22
H125	H4125	1½	15	1800	1½	2	400	25,000	200	300	225	36
HL125	HL4125	1½	30	1800	2	3	400	7,500	200	300	225	40
AK125	AK4125	2	60	1200	3	5	400	⑪25,000	150	300	226	76
AL125	AL4125	2	75	1200	5	7½	400	⑪25,000	150	300	225	81
K125	K4125	2	60	640	3	7½	400		200	300	225	105
KK125	KK4125	2	80	640	5	7½	400	26,000	200	300	225	110
L125	L4125	2	130	640	7½	15	400	25,000	200	300	225	155
LQ125	LQ4125	②2½	135	640	7½	15	400	2,500	200	300	225	175
LL125	LL4125	②3	140	520	7½	15	400	75,000	150	300	225	185
LS125	LS4125	②3	200	640	15	20	400	7,500	150	300	225	190
Q125	Q4125	④4	300	520	20	30	400	25,000	150	300	225	440
M125	M4125	④4	420	420	20	40	400	25,000	150	300	225	600

① Buna-N elastomer used in mechanical seal of Series 4125 pumps.

② "G" and "Q" sizes have steel idler.

⑦ For mechanical seal pumps on applications with viscosities above 15,000 SSU, provide details for recommendation.

④ Ports are suitable for use with 125# ANSI cast iron or 150# ANSI steel companion flanges or flanged fittings. All others tapped for standard pipe.

⑤ Standard seal can be used from –20°F. to +225°F. With special construction, temperatures from –60°F. to +650°F. can be handled with this series pumps.

⑥ Nominal rating based on handling thin liquids.

⑦ "AK," "AL," "KK" and "LS" sizes have Ductile Iron rotor.

⑧ For maximum recommended discharge pressures when handling other viscosities and/or other speeds, see performance curves. Performance curves also show preferred constructions. If suction pressure exceeds 50 PSIG, consult factory.

⑨ Check factory before using bronze rotors at viscosities normally requiring steel fitted construction. "G," "AK," "AL" and "LS" sizes not available in bronze fitted construction.

⑩ "AK," "AL," "LS," "Q" and "M" 4125 models furnished with carbon graphite bracket bushings and mechanical seal is mounted in stuffing box. Mechanical seal is mounted behind rotor in "G," "H," "HL," "K," "KK," "L," "LQ" and "LL" pumps.

⑪ "AK" and "AL" sizes not available in steel fitted construction.

Charlotte, NC (704)596-4373   Asheville, NC (704)687-4538   Raleigh, NC (919)832-8834   Winston-Salem, NC (919)723-1683   Columbia, SC (803)799-8090
Greenville, SC (803)299-0135   Chattanooga, TN (615)855-1417   Knoxville, TN (615)938-7728   Nashville, TN (615)350-6090

SPATCO

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VIKING® HEAVY-DUTY PUMPS
SERIES 125 AND 4125

UNMOUNTED PUMPS

"AK" and "AL" Sizes

"LQ" and "LL" Sizes

"Q" and "M" Sizes

"G," "H" and "HL" Sizes

"K," "KK" and "L" Sizes

"LS" Size

This series of heavy-duty pumps is available either un-mounted or mounted units as shown on following pages. Available with Multi-Ring stuffing box or Buna-N mechanical seal with carbon rotating and Ni-Resist stationary faces. The integral thrust bearing is designed to handle heavy-duty pumping jobs without problems of end play and distortion. For increased versatility of installation and complete selection of ports, the pump casing is designed so it can be rotated on the bracket to any 45° or 90° angle from

that shown in the illustrations. See revolvable casing feature on Page 141.3. Pressure relief valve on head is standard for this series. To permit use of this type pump in a greater range of applications, some sizes are available with jacketed head plate. For heavy-duty pumps with jacketed bracket and head, see Catalog Section 142.

Dimensions for Unmounted Pumps—See Page 141.11.
Performance Data for Unmounted Pumps—See Pages 141.17 through 141.42.

CONSTRUCTION—SERIES 125 AND ⊕4125 ("G" THROUGH "M" SIZES)

Pump Construction	Casing	Head	Bracket	Rotor	Idler	Rotor Shaft and Idler Pin	Bushings				Internal Relief Valve
							Packed		Mach. Seal		
							Idler	Bracket	Idler	Bracket	
Standard Construction	Iron	Iron	Iron	⊕ Iron	Iron	Steel	Bronze	Bronze	Carbon Graphite	⊕ Bronze	Iron
⊕ Steel Fitted	Iron	Iron	Iron	Steel	⊕ Iron	Steel	Bronze	Bronze	Carbon Graphite	⊕ Bronze	Iron
⊕ Bronze Fitted	Iron	Iron	Iron	⊕ Bronze	Bronze	Steel	Bronze	Bronze	Carbon Graphite	⊕ Bronze	Iron

SPECIFICATIONS—SERIES 125 AND ⊕4125 UNMOUNTED PUMPS

Model Number		Port Size	⊕ Nominal Pump Rating		Motor HP Required At Rated Speed Pumping 100 SSU Liquid		Maximum Hydro-Static Pressure	Steel Fitted Construction Recommended Above This Viscosity	⊕ Max. Rec. Discharge Pressure Handling 100 SSU Liquid At Rated Speeds	⊕ Maximum Recommended Temperature for Cataloged Pump. °F.		Approximate Shipping Weight With Valve
Packed	⊕ ⊕ Mech. Seal	Inches	GPM	RPM	50 PSI	100 PSI	PSIG	SSU	PSIG	Packed	Mach. Seal	Pounds
G125	G4125	1	8	1800	¾	1½	400	7,500	200	300	225	22
H125	H4125	1½	15	1800	1½	2	400	25,000	200	300	225	38
HL125	HL4125	1½	30	1800	2	3	400	7,500	200	300	225	40
AK125	AK4125	2	50	1200	3	5	400	⊕25,000	150	300	225	78
AL125	AL4125	2	75	1200	5	7½	400	⊕25,000	150	300	225	81
K125	K4125	2	60	640	3	7½	400		200	300	225	105
KK125	KK4125	2	80	640	5	7½	400	25,000	200	300	225	110
L125	L4125	2	135	640	7½	15	400	25,000	200	300	225	155
LQ125	LQ4125	⊕2½	135	640	7½	15	400	25,000	200	300	225	175
LL125	LL4125	⊕3	140	520	7½	15	400	2,500	200	300	225	185
LS125	LS4125	⊕3	200	640	15	20	400	75,000	150	300	225	190
Q125	Q4125	⊕4	300	520	20	30	400	7,500	150	300	225	440
M125	M4125	⊕4	420	420	20	40	400	25,000	150	300	225	600

① Buna-N elastomer used in mechanical seal of Series 4125 pumps.

② "G" and "Q" sizes have steel idler.

③ For mechanical seal pumps on applications with viscosities above 15,000 SSU, provide details for recommendation.

④ Ports are suitable for use with 125# ANSI cast iron or 150# ANSI steel companion flanges or flanged fittings. All others tapped for standard pipe.

⑤ Standard seal can be used from −20°F. to −225°F. With special construction, temperatures from −60°F. to +650°F. can be handled with this series pumps.

⑥ Nominal rating based on handling thin liquids.

⑦ "AK," "AL," "KK" and "LS" sizes have Ductile iron rotor.

⑧ For maximum recommended discharge pressures when handling other viscosities and/or other speeds, see performance curves. Performance curves also show preferred constructions. If suction pressure exceeds 50 PSIG, consult factory.

⑨ Check factory before using bronze rotors at viscosities normally requiring steel fitted construction. "G," "AK," "AL" and "LS" sizes not available in bronze fitted construction.

⑩ "AK," "AL," "LS," "Q" and "M" 4125 models furnished with carbon graphite bracket bushings and mechanical seal is mounted in stuffing box. Mechanical seal is mounted behind rotor in "G," "H", "HL", "K", "KK", "L", "LQ" and "LL" pumps.

⑪ "AK" and "AL" sizes not available in steel fitted construction.

GROTH CORPORATION

Tank Protection Division

Pressure/Vacuum Relief Valve with Pipe-Away Feature
Model 1220A

❏ Sizes 2" through 12"

❏ Pressure settings ½oz/in² to 15 PSIG

❏ Vacuum settings ½oz/in² to 12 PSIG

❏ Available in aluminum (type 356), carbon steel, stainless steel and other materials.

❏ Modular construction

MODEL 1220A

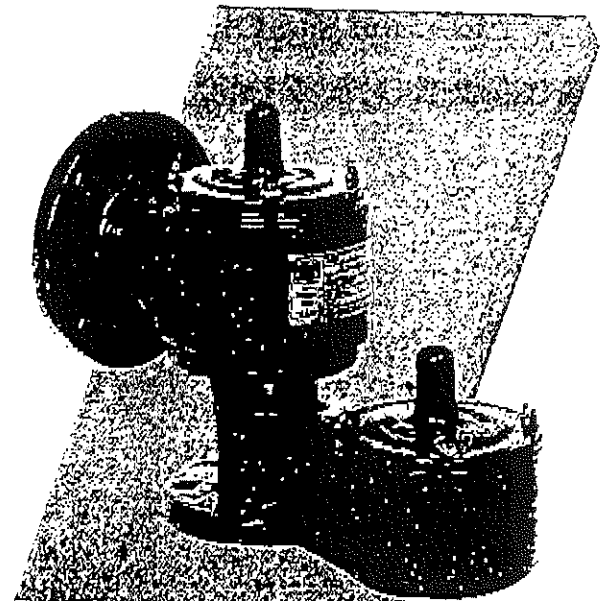

MODEL 1220A

MODEL 1221B

PRESSURE / VACUUM RELIEF VALVE WITH PIPE-AWAY FEATURE

Model 1220A is used for pressure and vacuum relief where vapors must be piped away. Special pallets in the Model 1220A housing virtually eliminate the intake of air and the escape of vapors except during normal tank breathing, thus reducing the loss of product. These special pallets are engineered to allow only the intake or outlet relief necessary to maintain the proper working pressure, thereby protecting the tank from possible damage. Escaping vapors are piped away through a flanged outlet connection. This helps to provide increased fire protection and safety.

SPECIAL FEATURES

Model 1220A offers Groth's special "cushioned air" seating. Superior performing Teflon³ seating diaphragms are standard to minimize sticking caused by resinous vapors and atmospheric moisture. The Model 1220A has a self draining housing body and drip rings to protect seating surfaces from condensate and freezing. This design also avoids pressure or vacuum buildup due to binding or clogging of the valve. Buna-N, Viton³ and other seating diaphragms can be provided when required. Model 1221B may be spring loaded when required for use on blanketed tanks or other type installation requiring higher settings. To insure the proper alignment of seating surfaces there is peripheral guiding and a center stabilizing stem.
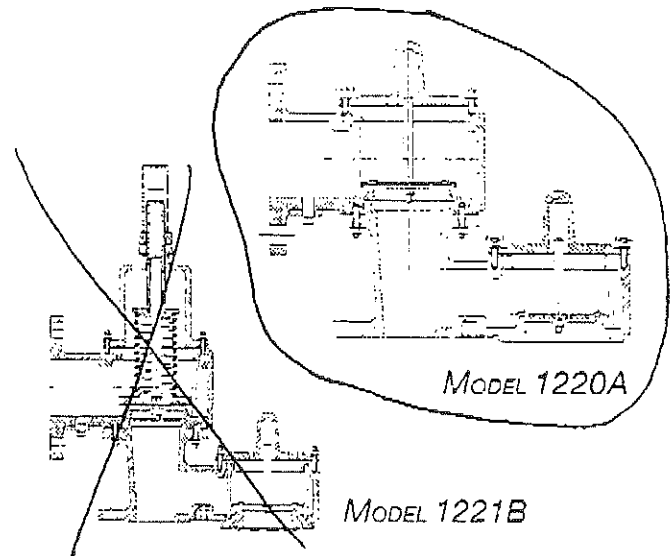
GROTH, THE CAPABILITY COMPANY

As with all Groth products, every Model 1220A is factory inspected and tested to meet your critical requirements and special needs. Inventory is maintained to insure rapid delivery.

GROTH CORPORATION

THIS CHART SHOWS CAPACITIES FOR PRESSURE/VACUUM VENT WITH FLAME ARRESTER

PRESSURE RELIEF CAPACITY

MODEL 1220A/7618

Set Pressure (P$_s$)		Air Flow Capacity at 100% Over-pressure (Double Set Pressure) 1000 Standard Cubic Feet per Hour at 60° F						
In WC	Oz/Sq In	2"	3"	4"	6"	8"	10"	12"
0.87	0.50	2.92	5.68	10.3	20.7	32.3	51.5	59.1
1.00	0.58	3.19	6.34	11.5	23.3	36.2	57.6	67.8
1.73	1.00	4.45	9.23	16.8	34.4	53.0	84.4	105
2.00	1.16	4.84	10.1	18.5	37.8	58.2	92.6	116
2.60	1.50	5.64	11.9	21.7	44.6	68.5	109	138
3.00	1.73	6.12	13.0	23.7	48.8	74.8	119	151
3.46	2.00	6.65	14.1	25.9	53.2	81.6	130	165
4.00	2.31	7.21	15.4	28.2	58.0	88.9	141	180
6.00	3.47	9.07	19.5	35.7	73.6	113	179	230
8.00	4.62	10.7	23.0	42.1	86.8	133	211	272
10.0	5.78	12.1	26.1	47.7	98.6	151	240	309
12.0	6.93	13.3	28.9	52.9	109	167	266	343
15.0	8.66	15.1	32.7	60.0	124	189	301	389
20.0	11.6	17.7	38.4	70.4	146	222	354	457
25.0	14.4	20.0	43.5	79.7	165	252	400	518
30.0	17.3	22.2	48.1	88.2	182	278	443	574

Flow capacity is certified by Groth Corporation, based on actual tests conducted in compliance with API Std. 2000.
Flow measurement accuracy has been verified by an independent testing laboratory.

Flow capacity values listed above are based on full open valves at 100% over-pressure.

Consult Factory for flow capacity with fiberglass valve.

Read the flow capacity at 100% over-pressure directly from the table above. Use linear interpolation if the set pressure is not listed. (Ref: Page TPD1)

If the allowable over-pressure is less than 100%, modify the flow capacity using the appropriate "C" factor from the table. If allowable over-pressure is more than 100%, consult page TPD1 or your Groth Representative.

Calculate the percentage over-pressure by the following formula. Note that all pressures are gage pressure expressed in the same units of measure.

P_f = Flowing pressure
P_s = Set pressure
% OP = $[(P_f - P_s)/P_s] \times 100$

Calculate flow capacity at less than 100% over-pressure according to the following example.

Example—To find "C" factor from table:
Read "C" factor for 75% Over-pressure at intersection of row 70 and column 5
"C" factor at 75% OP = **0.87**

	"C" Factor Table								
%OP	0	1	2	3	4	5	6	7	8	9
10										
20				Consult						
30				Factory						
40										
50	0.72	0.73	0.73	0.74	0.75	0.75	0.76	0.77	0.77	0.78
60	0.79	0.79	0.80	0.80	0.81	0.81	0.82	0.82	0.83	0.84
70	0.84	0.85	0.85	0.86	0.86	0.87	0.88	0.88	0.89	0.89
80	0.90	0.90	0.91	0.91	0.91	0.92	0.93	0.93	0.94	0.94
90	0.95	0.95	0.96	0.96	0.97	0.97	0.98	0.99	0.99	1.00

Example—Flow Capacity Calculation

6" Model 1220A/7618
4 In WC set pressure [P$_s$]
7 In WC flowing pressure [P$_f$]

1. Read flow capacity at set pressure from table
2. Calculate over-pressure
3. Read "C" factor from table
4. Calculate flow capacity

Flow = 58,000 SCFH
% OP = $[(7 - 4)/4] \times 100 = 75\%$
"C" = 0.87
Flow = 0.87 × 58,000 = 50,460 SCFH

Vacuum Capacity For Vent & Flame Arrester Combination

VACUUM RELIEF CAPACITY

MODEL 1220A/7618

Set Vacuum (P$_s$)		Air Flow Capacity at 100% Over-vacuum (Double Set Vacuum) 1000 Standard Cubic Feet per Hour at 60° F						
In WC	Oz/Sq In	2"	3"	4"	6"	8"	10"	12"
0.87	0.50	2.55	5.19	8.80	17.9	28.6	44.3	53.6
1.00	0.58	2.77	5.73	9.70	19.8	31.6	48.9	60.4
1.73	1.00	3.78	8.15	13.6	28.3	45.1	69.4	89.8
2.00	1.16	4.10	8.90	14.9	31.0	49.3	75.8	99.0
2.60	1.50	4.74	10.4	17.4	36.2	57.7	88.6	117
3.00	1.73	5.14	11.3	18.9	39.5	62.9	96.0	128
3.46	2.00	5.56	12.3	20.5	42.9	68.4	105	139
4.00	2.31	6.03	13.4	22.3	46.7	74.4	114	152
6.00	3.47	7.54	16.9	28.1	58.9	93.8	144	193
8.00	4.62	8.84	19.9	33.0	69.4	110	169	227
10.0	5.78	10.0	22.5	37.4	78.6	125	192	258
12.0	6.93	11.1	24.9	41.5	87.1	139	212	286
15.0	8.66	12.5	28.2	46.9	98.6	157	240	324
20.0	11.6	14.7	33.1	55.1	116	184	282	381
25.0	14.4	16.6	37.5	62.3	131	209	319	432
30.0	17.3	18.3	41.5	68.9	145	231	353	478

Flow capacity is certified by Groth Corporation, based on actual tests conducted in compliance with API Std. 2000.
Flow measurement accuracy has been verified by an independent testing laboratory.

Flow capacity values listed above are based on full open valves at 100% over-vacuum.

Consult Factory for flow capacity with fiberglass valve.

Read the flow capacity at 100% over-vacuum directly from the table above. Use linear interpolation if the set vacuum is not listed. (Ref. Page TPD1)

If the allowable over-vacuum is less than 100%, modify the flow capacity using the appropriate "C" factor from the table. If allowable over-vacuum is more than 100%, consult page TPD1 or your Groth Representative.

Calculate the percentage over-vacuum by the following formula. Note that all pressures are gage pressure expressed in the same units of measure.

P_f = Flowing pressure
P_s = Set pressure
% OV = $[(P_f - P_s)/P_s] \times 100$

Calculate flow capacity at less than 100% over-vacuum according to the following example.

Example—Flow Capacity Calculation

6" Model 1220A/7618
4 In WC set vacuum (P$_s$)
7 In WC flowing vacuum (P$_f$)

1. Read flow capacity at set vacuum from table
2. Calculate over-vacuum
3. Read "C" factor from table
4. Calculate flow capacity

Example—To find "C" factor from table:
Read "C" factor for 75% Over-vacuum at intersection of row 70 and column 5
"C" factor at 75% OV = 0.87

"C" Factor Table										
%OV	0	1	2	3	4	5	6	7	8	9
10										
20				Consult						
30				Factory						
40										
50	0.72	0.73	0.73	0.74	0.75	0.75	0.76	0.77	0.77	0.78
60	0.78	0.79	0.80	0.80	0.81	0.81	0.82	0.82	0.83	0.84
70	0.84	0.85	0.85	0.86	0.86	0.87	0.88	0.88	0.89	0.89
80	0.90	0.90	0.91	0.91	0.91	0.92	0.93	0.93	0.94	0.94
90	0.95	0.95	0.96	0.96	0.97	0.97	0.98	0.99	0.99	1.00

Flow = 46,700 SCFH
% OV = $[(7 - 4)/4] \times 100 = 75\%$
"C" = 0.87
Flow = 0.87 × 46,700 = 40,629 SCFH

GROTH CORPORATION
Tank Protection Division

FLAME ARRESTERS

MODELS 7618/7628

- ☐ Sizes 2" through 60"
- ☐ Available in, carbon steel, stainless steel aluminum (type 356) and other materials
- ☐ Wafer design for quick and easy maintenance
- ☐ Unique recessed seating for superior protection
- ☐ Factory Mutual approval for most sizes and materials
- ☐ Proven spiral wound, crimped ribbon, flame element

FLAME ARRESTER

Both models are designed to inhibit flame propagation in gas piping systems and to protect low pressure tanks containing flammable liquids. Arresters protect low flash point liquids from externally caused sources of heat and ignition. This provides increased fire protection and safety.

SPECIAL FEATURES

Both models are built of corrosion resistant materials throughout. Wafer design construction affords easy accessibility to the flame bank. Additionally, jack screws aid in the removal from the shell assembly. All Groth flame arrester flame banks utilize spiral wound, crimped ribbon constructed flame elements. These proven, Factory Mutual approved elements have been reported, by NTIS of the Dept. of Commerce, to provide the best flame quenching performance for the least pressure drop. Groth's special recessed flame bank seating construction uniquely provides an extra measure of protection against leakage and possible flame propagation.

GROTH, THE CAPABILITY COMPANY

As with all Groth products, every Flame Arrester is factory inspected and tested to meet all critical requirements and special needs. Inventory is maintained to insure rapid delivery.
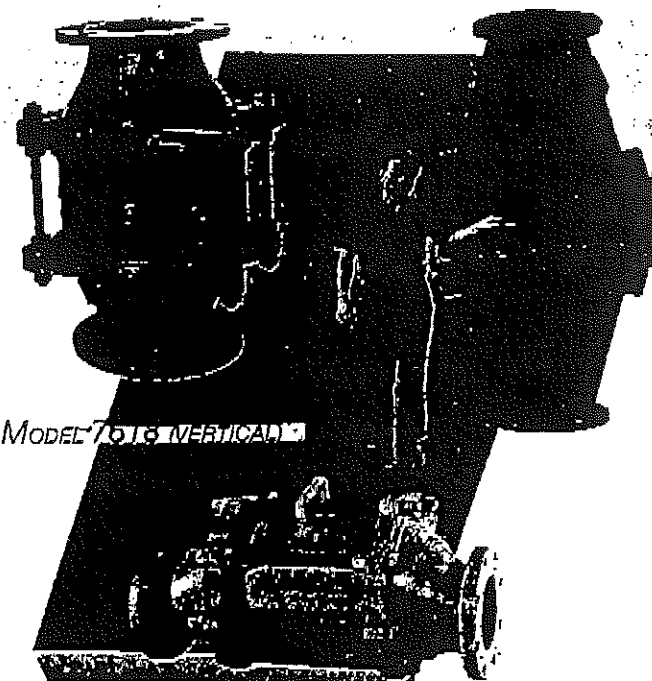
MODEL 7618 (VERTICAL)

MODEL 7628 (HORIZONTAL)
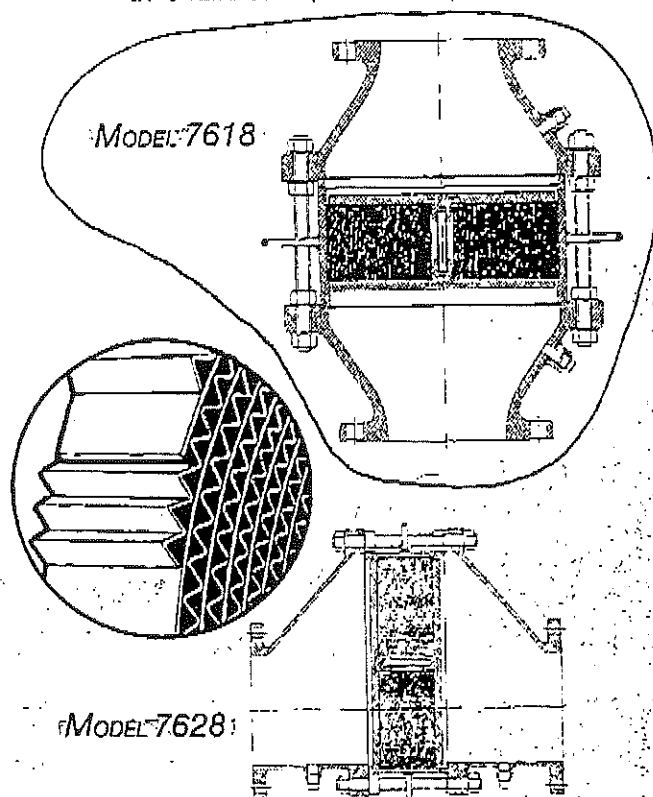
MODEL 7618

MODEL 7628

Note: All Groth Flame Arresters are Bi-directional. Factory Mutual regulates that Flame arresters be installed with 10 pipe diameters of the source of ignition.

SPECIFICATION TABLE • MODELS 7618 / 7628

Specifications subject to change without notice. Certified dimensions available upon request.

Size[1]	A Width (Metric)	B Height (Metric)	AA Length (Metric)	BB Height (Metric)	MAWP 7618 Aluminum (Metric)	MAWP 7618 Carbon or SS (Metric)	MAWP 7628 Aluminum (Metric)	MAWP 7628 Carbon or SS (Metric)	Approx. Ship. Wt. Lbs. (Aluminum)
2" (51 mm)	8½" (221)	14" (356)	13¾" (349)	9½" (241)	50 PSIG (345 kPa)	100 PSIG (693 kPa)	150 PSIG (1035 kPa)	350 PSIG (2415 kPa)	18 (8kg)
3" (76 mm)	9½" (241)	16" (406)	15¾" (400)	11" (279)	50 PSIG (345 kPa)	100 PSIG (690 kPa)	140 PSIG (966 kPa)	325 PSIG (2242 kPa)	25 (11 kg)
4" (102 mm)	11½" (292)	18¼" (464)	18" (457)	12½" (318)	50 PSIG (345 kPa)	100 PSIG (693 kPa)	140 PSIG (966 kPa)	325 PSIG (2242 kPa)	40 (18 kg)
6" (152 mm)	16½" (419)	21" (533)	21" (535)	16½" (419)	50 PSIG (345 kPa)	100 PSIG (690 kPa)	140 PSIG (966 kPa)	325 PSIG (2242 kPa)	70 (22 kg)
8" (203 mm)	21" (533)	25" (659)	25" (653)	20½" (521)	50 PSIG (345 kPa)	100 PSIG (690 kPa)	90 PSIG (621 kPa)	200 PSIG (1380 kPa)	135 (61 kg)
10" (254 mm)	24¾" (629)	30" (762)	30" (762)	24½" (622)	50 PSIG (345 kPa)	100 PSIG (690 kPa)	75 PSIG (517 kPa)	150 PSIG (1035 kPa)	235 (127 kg)
12" (305 mm)	28¾" (727)	32½" (825)	32½" (876)	28½" (724)	50 PSIG (345 kPa)	100 PSIG (690 kPa)	75 PSIG (517 kPa)	150 PSIG (1035 kPa)	345 (156 kg)

[1] Larger sizes available on special application. 150# A.N.S.I. drilling compatibility, F.F. on aluminum and R.F. on carbon steel and stainless steel alloys.

HOW TO ORDER
FOR EASY ORDERING, SELECT PROPER MODEL NUMBER

MODEL #   7 6 1 8

7618 Vertical
7628 Horizontal

SIZE   0 2

02"
Thru
60"

MATERIAL   1   1

→ Flame element winding

→ Body Material

1 = Aluminum
3 = Carbon Steel
5 = 316 SS
Z = Special

OPTIONS   F 0 0

0 = No Options
Z = Special Options

0 = No Jacket
J = Steam Jacket

F = Flanged outlet (in-line design)
W = Weatherhood (replaces flanged outlet)
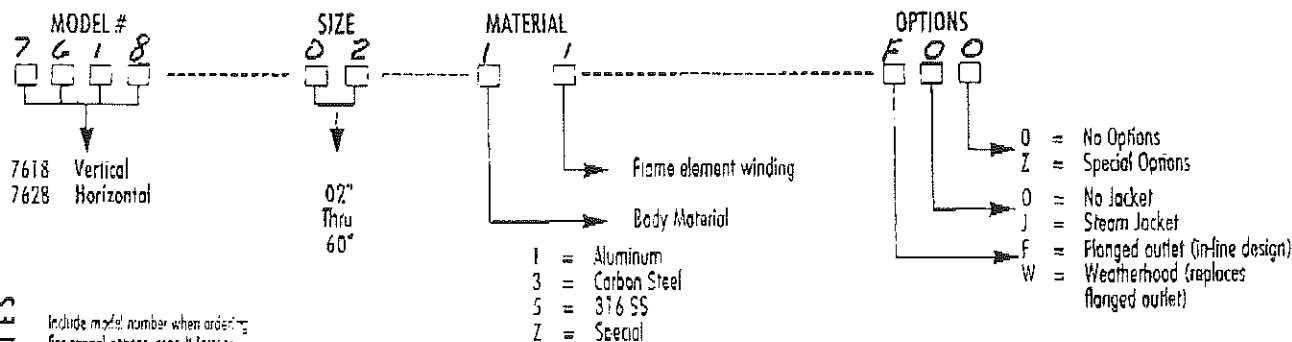
NOTES
Include model number when ordering.
For special options, consult factory.
When ordering steam jacket, include steam pressure/temperature.

EXAMPLE   7 6 2 8 — 0 2 — 1 5 — F 0 0

Indicates a 2" Model 7628 with Aluminum Body, 316 SS Flame Element Winding, Flanged Outlet and no other options.

GROTH

CORPORATION ®

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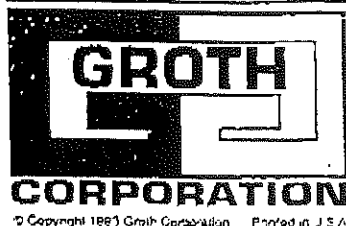
GROTH IS COMMITTED TO THE TOTAL QUALITY IMPROVEMENT PROCESS

1202 Hahlo • P.O. Box 15293
Houston, Texas 77220-5293
713/675-6151 FAX 713/675-6739
Groth Products Group
1-800-552-2960 (Except Tex. & La.)

ISO 9001
Certificate Number: 30124

Form 10M993
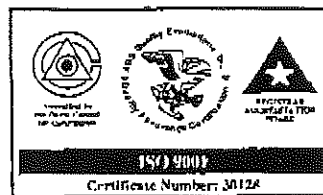
SPATCO

OPW® The Dry-Disconnect Experts Introduce the D-2000 Dry-Disconnect Coupling.
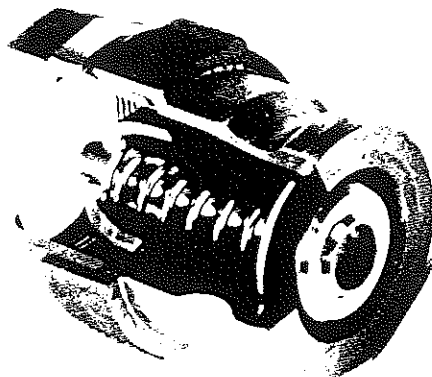
OPW Kamvalok® Adaptor
Model 1611 A
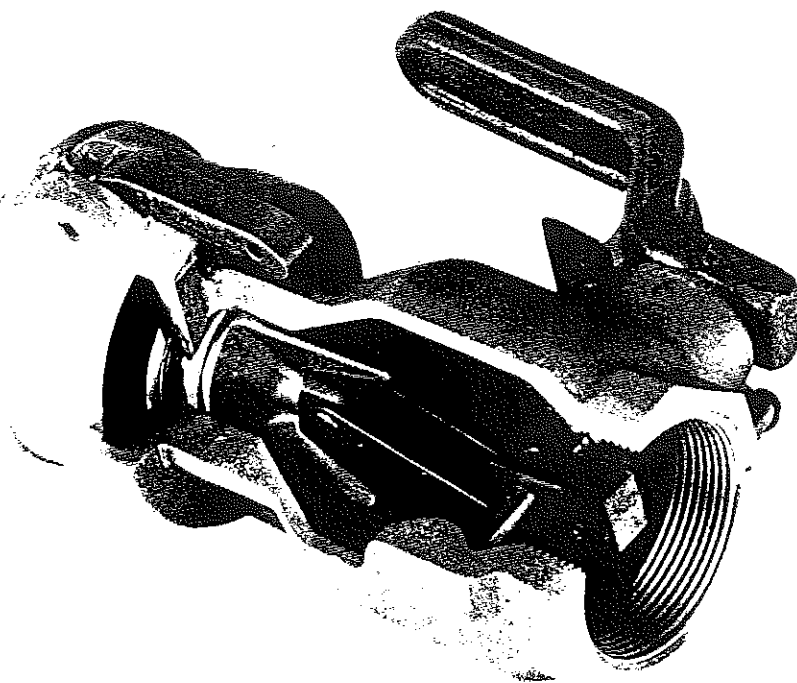
OPW D-2000 Coupler
Model 2261 D

If you want to avoid spillage, you need the OPW D-2000 Dry-Disconnect Cam and Groove Quick Coupling. The D-2000 helps prevent spillage from disconnect. Your product stays in the line – and off the floor.

- *Easy-to-Clean Design*
- *Built-in Valve*
- *Low Cost Design*
- *Heavy Duty Construction*

- *Easy-to-Use Cam and Groove Design*
- *Compatible with Kamvalok® Adapters*
- *Simple Design for Reliable Operation*

| Charlotte, NC (704)596-4373 | Asheville, NC (704)667-4536 | Raleigh, NC (919)832-6634 | Winston-Salem, NC (919)723-1683 | Columbia, SC (803)799-8090 |
| Greenville, SC (803)299-0135 | Chattanooga, TN (615)855-1417 | Knoxville, TN (615)938-7728 | Nashville, TN (615)350-8080 | |

SPATCO   285

Styles

1700-D* Series
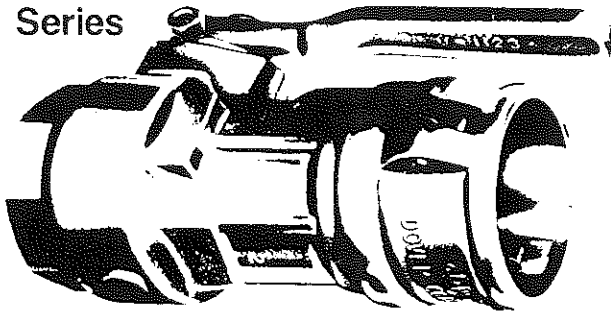
1600-A* Series

The Kamvalok® coupler and adaptor are designed with female threads, and can be fitted to either a male pipe end or to a hose fitting.
SIZES: 1½", 2", 3"

1762-DP

OPW DOVER CURB
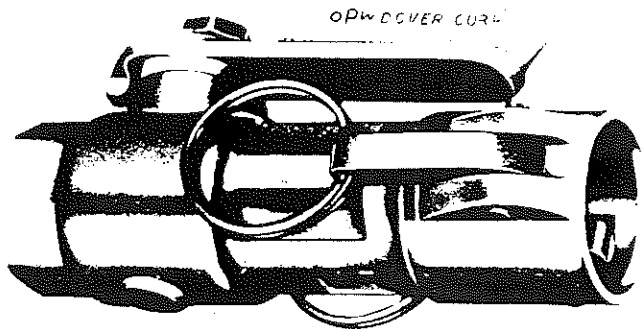
1662-A
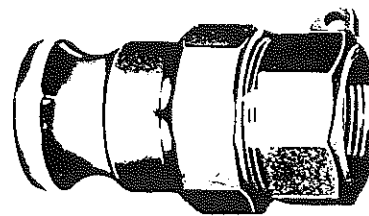
These special Kamvalok couplers and adaptors are used primarily for low flow applications.
SIZE: ¾"

D-2000* Series
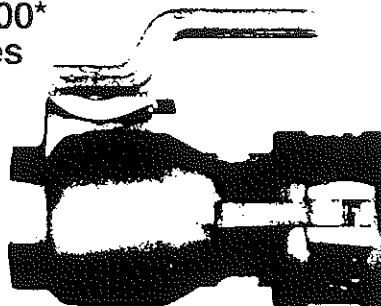
The D-2000 coupler has been designed for applications requiring automatic closure in one direction, from adaptor side only.
SIZES: 1½", 2"

Note: For correct product number consult availability chart specifying metal and/or seal construction.

OPW

Charlotte, NC (704)596-4373 ▶ Asheville, NC (704)667-4536 ▶ Raleigh, NC (919)832-6634 ▶ Winston-Salem, NC (919)723-1683 ▶ Columbia, SC (803)799-8090
Greenville, SC (803)299-0135 Chattanooga, TN (615)855-1417 Knoxville, TN (615)938-7728 Nashville, TN (615)350-8080

SPATCO 286
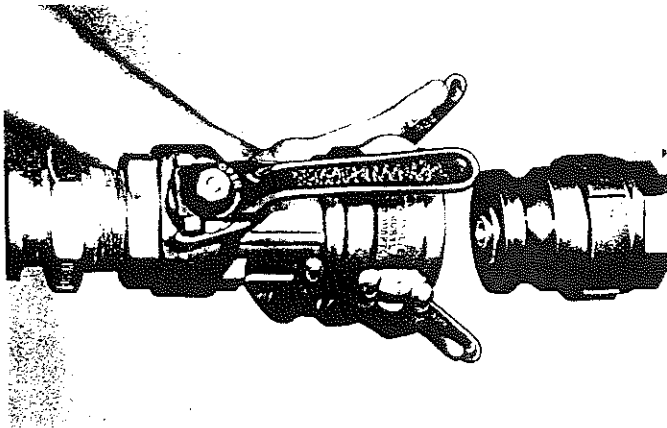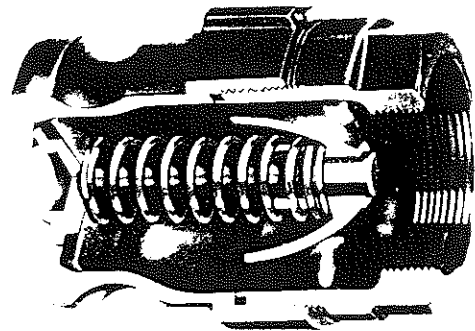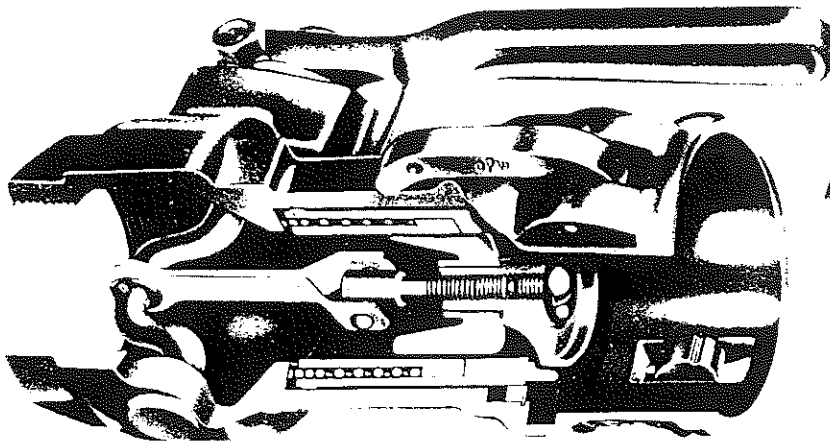
Operation

1. Couple in any position
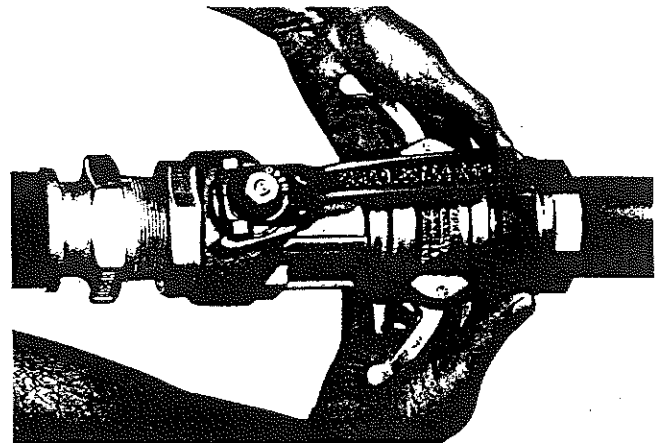
2. Cam arms lock coupler and adaptor together
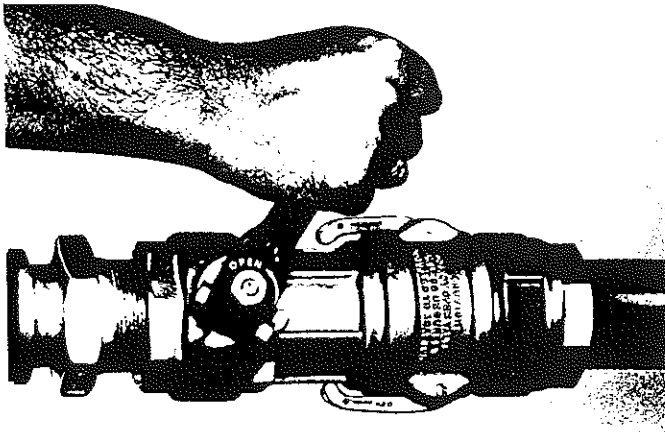
3. Lever opens valve
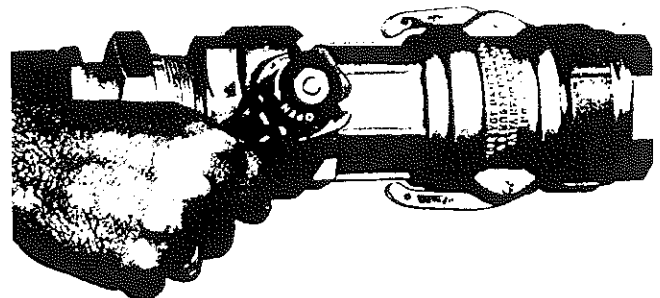
4. Full flow starts

OPW®

FLUID HANDLING GROUP
DOVER CORPORATION / OPW DIVISION

REFRIGERATED COMPRESSED AIR DRYERS

THREE-IN-ONE COMPRESSED AIR DRYERS

- 3-in-1 design combines aftercooler, refrigerated dryer, and reheater in a single unit. Eliminates need for a separate aftercooler to precool the incoming air from compressor
- Handles inlet air temperature up to 180°F
- Produces 35°F pressure dewpoint. Removes 96% of harmful moisture from compressed air. Helps protect air system components, spray guns, air tools, sandblasters and other pneumatic equipment
- Single unit reduces installation, operating and maintenance cost

- Operates in hot environments (up to 100°F maximum ambient temperature)
- All copper spiral fin tube-in-tube heat exchanger provides maximum efficiency for heat transfer and water separation
- Heat exchanger warranted for 5 years
- Includes monitoring instrumentation, separator, and drain trap
- Standard 6 ft cord plugs into any 115V wall outlet (115V models only)
- Refrigeration systems utilize environmentally safe R-22 refrigerant

SPEEDAIRE

Made in the U.S.A.

Nos. 5Z761 & 5Z762

Max. Air Compressor HP	CFM Capacity @ 35°F Pressure Dew Point	HP	Volts 60 Hz	Inlet/Outlet (F)NPT	Dimensions H	W	D	Stock No.	List	Each	Shpg. Wt.
5	22	1/3	115	1"	21"	26"	16"	5Z656	$1250.00	$1157.00	110.0
10	37	1/2	115	1	26	30	20	5Z657	1575.00	1457.00	140.0
15	56	3/4	115	1	26	30	20	5Z658	2135.00	1975.00	170.0
25	91	1	230	1	31⅛	34¼	27⅛	5Z659	3050.00	2822.00	235.0

REFRIGERATED COMPRESSED AIR DRYERS

amb ir filter to protect

equ nts

ed, ᴄ A certified

green finish

hose between air compressor o prolong equipment life. Sep ove condensed water and oil 1858 for separators and drains

	List	Each
57	$315.00	$257.75
58	345.00	282.00
59	450.00	375.00
50	607.00	498.00
51	780.00	640.00
52	1040.00	849.00

oil, and contaminants from

ilt with corrosion resistant cop al baffles

movable for servicing

l aftercoolers so water flow ssed air. 250 PSI maximum water pressure. 500°F maxi ting feet at both ends. Green

List	Each
$203.00	$170.75
229.50	192.00
448.00	367.25

Hankison refrigerated dryers eliminate harmful moisture and provide high quality, clean, dry air.

- Consistent outlet dew points assure dry air downstream
- Built-in oil and dirt removal filter eliminates contaminants
- Large precooler/reheaters allow use of smallest refrigeration systems possible, minimizing energy requirements
- Smooth surface heat exchangers permit low pressure drop through dryer
- Heat exchangers are fully encapsulated in non-degrading insulation to preserve cooling effect
- Efficient, direct expansion type heat exchangers respond quickly to changes in load
- Non-fouling, smooth surface, copper heat exchangers maintain high heat transfer efficiency for life of dryer, no prefilter required
- Accurate control of refrigeration temperature eliminates need for manual adjustments as load or ambient temperature changes

- Positive condensate discharge with compressed air powered automatic drain
- Two-stage separator maintains high efficiency separation across wide range of flows
- Refrigeration system service life maximized by continuous, non-cycling operation
- Refrigeration systems utilize environmentally safe R-134A or R-22 refrigerants

Nos. 6W474, 6W475, and 6W476 feature integral oil/dirt filter, power-on and high temperature warning lights, and six foot power cord with plug. Full cabinet includes removable end screens and wall mounting bracket.

Nos. 6W477 thru 6W482 have all features of No. 6W474. Also include on/off switch, refrigerant suction pressure gauge, and mounting feet instead of brackets.

Nos. 6W483 and 6W484 feature integral oil/dirt filter, and power-on, compressor-on, and high temperature warning lights. Full cabinet includes removable end screens and mounting feet. Also includes refrigerant suction pressure gauge.

HANKISON INTERNATIONAL
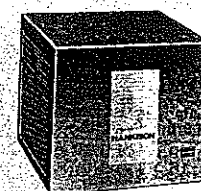
NEW LINE
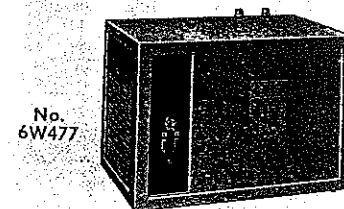
No. 6W475

No. 6W477

Max. Air Compr. HP	CFM Cap. @ Pressure Dew Pts. 38°F	50°F	Refrig. Comp. HP	Volts/ Phase 60 Hz	Inlet and Outlet	Overall Dimensions H	W	D	Mfr's. Model	Stock No.	List	Each	Shpg. Wt.
1½	5	7	1/10	115-1	3/8" OD	14"	16⅛"	15"	PR5	6W474	$507.00	$459.50	50.0
3	10	13	1/6	115-1	3/8 OD	14	16⅛	15	PR10	6W475	577.00	521.50	57.0
5	15	20	1/5	115-1	3/8 OD	14	16⅛	15	PR15	6W476	712.00	644.50	65.0
7½	25	33	1/5	115-1	3/4*	21	26	16	PR25	6W477	1010.00	898.00	117.0
10	35	46	1/5	115-1	3/4*	21	26	16	PR35	6W478	1265.00	1195.00	119.0
15	50	65	1/4	115-1	1*	25	34	22	PR50	6W479	1690.00	1620.00	203.0
20	75	98	1/3	115-1	1*	25	34	22	PR75	6W480	2100.00	2010.00	219.0
25	100	130	1/2	115-1	1*	25	34	22	PR100	6W481	2275.00	2170.00	236.0
30	125	163	3/4	115-1	1½*	25	34	22	PR125	6W482	2625.00	2485.00	245.0
40	150	195	3/4	115-1	2*	36⅝	36⅛	40⅛	PR150	6W483	3250.00	3095.00	437.0
50	200	260	1	460-3	2*	36⅝	36⅛	40⅛	PR200	6W484	3900.00	3630.00	440.0

(*)(M)NPT.

Dryer capacities at 38° and 50° pressure dew point temperatures have been established with compressed air entering dryer at 100 psig and 100°F saturated with dryer operating in 100°F ambient temperature. Operating range: 35° to 110°F ambient. Maximum working pressure: 175 psig. Maximum inlet compressed air temperature: 120°F. If inlet temperatures exceed 120°F, precool air with air or water cooled aftercooler.
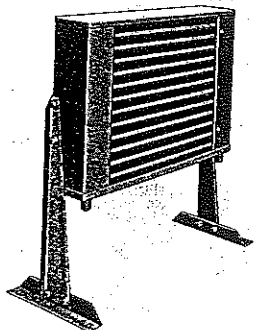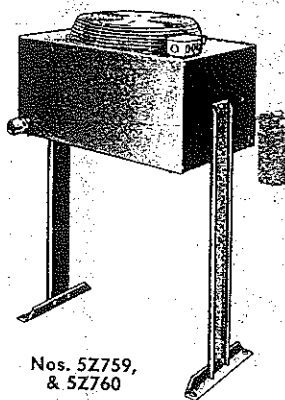
AFTERCOOLERS

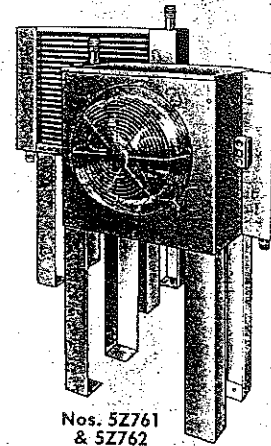## AIR-COOLED AFTERCOOLERS

SPEEDAIRE

Nos. 5Z757-5Z760 may be mounted for either vertical or horizontal discharge.

Nos. 5Z757, & 5Z758

Nos. 5Z759, & 5Z760

Nos. 5Z761 & 5Z762

- Remove harmful water, oil, and contaminants from compressed air systems
- Precool hot air from compressor to temperatures required for use with compressed air dryers
- High efficiency copper tube/aluminum fin heat exchangers provide close approach temperatures with minimal power consumption
- Heavy-duty construction for long, trouble-free life
- Single point electrical junction box for ease of installation
- Includes brackets/legs for floor or suspended mounting

- Nos. 5Z759-5Z762 include ambient air filter to protect com from airborne contaminants
- Guards conform to OSHA requirements
- Fan motors are UL recognized, CSA certified
- Steel cabinets have metallic green finish

NOTE: Use of flexible metal hose between air compressor and aftercooler is recommended to prolong equipment life. Separa tor and drain required to remove condensed water and oil. See page 2007 for hose and page 1858 for separators and drains.

Maximum Comp. HP	Max. CFM @ 100 PSI*	Fan HP	Volts, 60 Hz	Inlet/Outlet (F)NPT	Dimensions			Stock No.	List	Each	Ship Wt.
					H	W	D				
5	20	1/12	115	½"	21⅛"	20⅜"	9⅝"	5Z757	$315.00	$257.75	24
10	35	1/12	115	½	21⅛	20⅜	9⅝	5Z758	345.00	282.00	30
15	50	1/12	115	1	42¼	26⅛	15½	5Z759	450.00	375.00	65
25	100	1/12	115	1½	42¼	26⅛	15½	5Z760	607.00	498.00	68
35	150	1/4	115	1½	46½	43½	17¾	5Z761	780.00	640.00	150
50	240	1/4(2)	115	2	49½	47⅝	17¾	5Z762	1040.00	849.00	225

(*) Ratings based on 15°F approach with 250°F inlet temperature.

WATER-COOLED AFTERCOOLERS

SPEEDAIRE
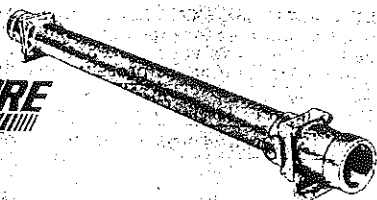
- Remove damaging water, oil, and contaminants from com pressed air systems
- Highly efficient cooler is built with corrosion resistant copp tubes, brass shell and internal baffles
- Cast iron end bonnets are removable for servicing

For best performance, install aftercoolers so water flows opposite direction to compressed air. 250 PSI maximum a pressure. 250 PSI maximum water pressure. 500°F maximu operating temperature. Mounting feet at both ends. Green m tallic finish. Speedaire brand.

Maximum Comp. HP	Max. CFM @ 100 PSI*	Cooling Area Surface	NPT Inlet & Outlet		Dimensions			Stock No.	List	Each	
			Water	Air	L	W	H				
0	40	3.5 sq. ft.	½"	1"	23¼"	3⅛"	3¼"	5Z625	$203.00	$170.75	
25	110	5.0	½	1½	36⅜	3⅛	3¼	5Z626	229.50	192.00	
0	300	18.6	1	2½	50⁵⁄₁₆	5¼	6¼	5Z627	448.00	367.25	

oling compressed air to 15°F above inlet water temperature.

CHAMPION DESIGN

- For auto repair, body shops, air tool operation, and automated machinery
- All models comply with State of California Code 462 (L) (2)
- Green finish

SPLASH LUBRICATED PUMPS

- Multifinned aluminum cylinder with cast iron liner combines inner strength of high density cast iron with cooling efficiency of an aluminum exterior
- 15 and 25 HP models have dual control for stop/start or continuous run operation, cast iron cylinders and heads, and an oil monitor which prevents unit from starting if proper oil level is not maintained
- Rugged, ductile iron crankshaft is counterbalanced with large diameter throws for low bearing loads
- Maximum cooling with precision balanced, fan-bladed flywheel
- Swedish steel, single-unit, plate-type valves are easy-to-service; cylinder does not need to be removed
- High density, die-cast aluminum alloy connecting rods minimize reciprocating weight
- Gasket-free integral cylinder head
- Aluminum alloy first stage piston is weight matched to second stage piston ensuring reciprocating balance
- Positive acting, governor-type, centrifugal unloader assures unloaded starts
- Unit shipped with oil in crankcase

MOTOR FEATURES

- Dual voltage NEMA motors

ENGINE FEATURES

- 10 HP Kohler Magnum engine with electronic ignition
- Large capacity dual element air cleaner

TANK MOUNT FEATURES

- ASME tank and safety valve. Includes bucket high drain valve, 300 PSI pressure gauge, and tank shutoff valve
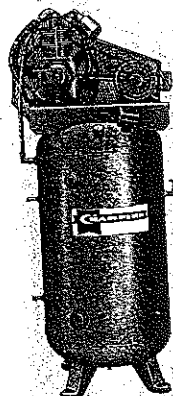
No. 5Z064
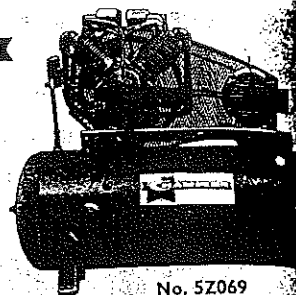
No. 5Z069

No. 5Z068

CHAMPION PNEUMATIC 5-YEAR LIMITED WARRANTY

Champion Pneumatic warrants compressors for 5 years. Text of warranty available on request. See "Manufacturers' Warranties" on page opposite inside back cover.

Made in the U.S.A.
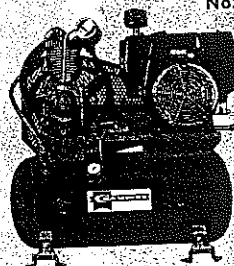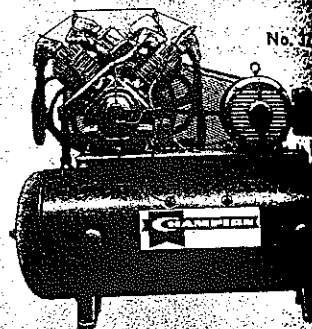
COMPRESSOR SPECIFICATIONS

HP	Stock No.	RPM	Cyls	Pump Bore	Stroke	Oil Cap.	(M)NPT Outlet
5	5Z064 5Z065 5Z066 5Z067	710	2	4⅝" 4⅝ 2½ 2½	3	2 qt	¾"
10	5Z069	765	4	4⅝	3	4	¾
10	5Z068	710	2	2½	3	2	¾
15	3Z412	770	2	6¼	4½	4	1¼
25	3Z413	770	4	6¼	4	6½	1¼

ELECTRIC MODELS

HP	Phase	Voltage, 60 Hz	Gallons	Tank Type	Displ CFM	CFM @ 175 PSI	Champion Model	Stock No.	List	Each	Shpg. Wt.	Volts, 60 Hz	Stock No.	List (With Magnetic Starter)	[Ea]
5	1	230	80	Vertical	20.7	16.5	VR5-8	5Z064	$2873.00	$1704.00	540.0	230	7Z446	$3064.15	$1831
5	1	230	80	Horizontal	20.7	16.5	HR5-8	5Z065	2873.00	1704.00	540.0	230	7Z447	3064.15	1831
5	3	230/460	80	Vertical	20.7	16.5	VR5-8	5Z066	2722.00	1602.00	540.0	230 460	7Z448 7Z449	2908.35 2906.35	174 174
5	3	230/460	80	Horizontal	20.7	16.5	HR5-8	5Z067	2722.00	1602.00	540.0	230 460	7Z450 7Z451	2908.35 2906.35	174 174
10	3	230/460	120	Horizontal	44.6	34.4	HR10-12	5Z069	4957.00	2882.00	890.0	230 460	7Z452 7Z453	5115.05 5040.23	307 302
15	3	230/460	120	Horizontal	61.5	53.7	HRA15-12	3Z412	6415.00	4065.00	1144.0	230 460	7Z454 7Z455	7142.22 7038.00	427 422
25	3	230/460	120	Horizontal	109.4	91.0	HRA25-12	3Z413	8467.00	5361.00	1350.0	230 460	7Z456 7Z457	9584.60 9295.60	575 557

GAS MODEL (KOHLER MAGNUM ENGINE)

HP	Phase	Voltage, 60 Hz	Gallons	Tank Type	Displ CFM	CFM @ 175 PSI	Champion Model	Stock No.	List	Each	Shpg. Wt.
10	—	—	30	Horizontal	20.7	16.5	HGR5-3	5Z068	3204.00	1917.00	400.0

(*) Magnetic starters are not mounted and wired; provided separately.

SECTION 13220

ABOVEGROUND STORAGE TANK

PART 1 GENERAL

1.01   SECTION INCLUDES

   A.   Furnish and install four 12,000-gallon carbon steel aboveground
        storage tanks.

   B.   Furnish and install new tank accessories and controls as shown
        on plan sheets or specified herein.

1.02   REFERENCES

   A.   NFPA 30--Flammable and Combustible Liquids Code.

   B.   Underwriters Laboratory--Standard for Safety 1316.

   C.   File MH 9061 for storage of flammable liquids.

1.03   SUBMITTALS

   A.   Submit shop drawings and product data.

   B.   Indicate for each tank, location of all fittings, accessories,
        critical dimenstions, anchoring devices, attachment, piping,
        and accessories.

   C.   Submit manufacturer's installation and testing instructions.

1.04   DELIVERY, STORAGE, AND HANDLING

   A.   Deliver products to site.

   B.   Store and protect products.

   C.   Handle and store tank at site in accordance with manufacturer's
        instructions and recommendations.

   D.   Secure tanks with tie downs at site until installed.

PART 2 PRODUCTS

2.01   DESIGN PARAMETERS

   A.   The storage tanks shall be designed with a vertical
        configuration with a dish bottom and a flat top. See Sheet 9

of 10. The bottom is dished to prevent material bridging during discharge and to improve mixability of any residual solids. The top of the tank is flat to permit easy access to top entering fittings. The top of tank(s) will have a peripheral handrail to protect personnel. The top of the tank will have additional channel stiffeners to support mixer weight and torque.

B. The tank will be of 5/16-inch wall thickness which will permit up to 1/8-inch for corrosion and erosion allowance. However, the waste solvents and inks being processed would not be expected to be corrosive to carbon steel.

C. The discharge from the tank(s) will be from the very bottom. The fill point for the tank(s) will be near the bottom of the vertical wall. A check valve will be located in the influent line adjacent to the tank to prevent tank drainage in the unlikely event of pipe failure upstream in the influent line to the storage tank(s).

D. The outside surface of the tank(s) will be prepped, primed, and finished with an alkyd enamel.

E. The tank(s) will be provided with a pressure / vacuum vent for normal operation and an emergency bent for abnormal operation. In addition, the unfilled portion of the tank(s) will be blanketed with nitrogen to prevent an explosive atmosphere from existing in the tank(s).

F. The tank(s) will be provided with a liquid level indicator to monitor tank operation.

2.02   AUXILIARY PIPING

A. The piping to the tank farm will be enclosed in a secondary containment trough. See Sheet 10 of 10. The trough will be suppored with columns at 25-foot centers. The lower portion of the pipe support column will be constructed of reinforced concrete to prevent pipe support damage from a wayward vehicle. The piping and trough will slope towards the tank farm with an integral sump at the tank farm end of the trough. The sump will have a liquid sensor to detect any leak in the process piping.

PART 3   EXECUTION

3.01   INSPECTION

A. Perform pre-installation tank tightness testing according to manufacturer's instructions to verify tank integrity prior to

installation.

B.   Verify that dimensions and elevations are as shown on plan
      sheets prior to placement of tank.

3.02   TANK INSTALLATION

A.   Install tank in strict accordance with manufacturer's written
      instructions, API Recommended Practice 1615 where applicable,
      and as indicated on plan sheets. Call to the attention of
      Architect / Engiener any conflict between manufacturer's
      recommendations and requirements herein for resolution.

B.   Install tank inventory probe and connect to new console
      according to manufacturer's written instructions and as
      required for a properly operating system. Provide all required
      electrical conduits, circuits, and connections from console to
      equipment at tank as necessary for proper operation of
      equipment.

END OF SECTION

STRESS CALCULATIONS

TANK FARM - CONTAINMENT WALL
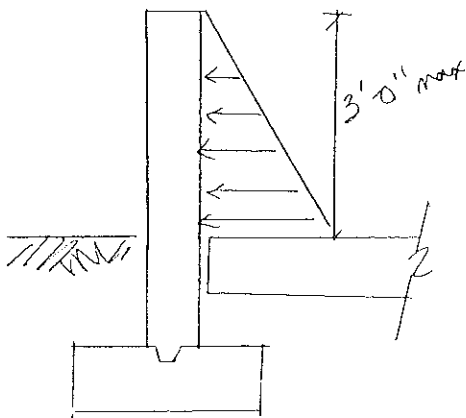
$$WT = 62.4 \, PSF/FT \, (2.5) = 156 \, PSF/FT$$

FOR 1'-0" WIDE SECT.   156 PLF/FT

$$M_u = \frac{1.7 \, (156 \, PLF/FT)(3')^3}{6} = 1.2 \, k\text{-}ft$$

TRY 12" THICK WALL $d = 12" - 3" - \frac{1}{2}" = 8.5"$

$b = 12"$ $f'_c = 4000 \, psi$ $f_y = 60 \, ksi$

$$F = \frac{bd^2}{12000} = \frac{12(8.5)^2}{12000} = 0.072$$

$$K = \frac{M_u}{F} = \frac{1.2}{.072} = 16.61$$

$$\rho_{min} = 1.33(0.0013) = 0.0017$$

$$A_{ST} = 0.0017(12")(8.5) = 0.17 \, in^2/FT$$

#4 @ 12" O.C.   ACTUAL $A_{ST} = 0.2 \, in^2/FT$ (VERTICAL)

min wall reinforcement -

VERT. $\rho = 0.0012$ HORIZ. $\rho = 0.002$

$VERT = 0.0012(12")(12") = .173 \dfrac{in^2}{FT}$ $HORIZ = 0.002(12)(12) = 0.288 \, in^2/FT$

WITH 2 FACES OF STEEL
USE #4 @ 12" O.C.

$$2(.2 \, in^2/FT) = 0.4 \, in^2/FT$$

USE #4 @ 12" O.C. EA. WAY - EA. FA.

TANK FARM
  MAT FOUNDATION DESIGN

Sheet 1 of 2

PRELIMINARY

DETERMINE UNIFORM LOAD UNDER TANKS

FULL TANK WEIGHT
  MATERIAL STORED SPECIFIC GRAVITY = 2.5

12000 gallons = 1605 ft³

$$W = 62.4 \, pcf \times 2.5 \times 1605 \, ft^3 = 250K + 5\% \text{ FOR TANK WT}$$

$$250K + 12.5K = 262.5K$$

USE 280K/TANK

EACH TANK HAS 4 POSTS $\dfrac{280K}{4} = 70K/POST$

FOR ENTIRE MAT SLAB THERE IS A 30'×30' LOAD DISTRIBUTION AREA

4 TANKS × 280K/TANK = 1120K

$$\frac{1120K}{30' \times 30'} = 1.244 \, ksf = 1244 \, psf \quad \text{UNIFORM LOADING}$$

ASSUMED ALLOWABLE BEARING PRESSURE = 1500 psf
  (THIS WILL BE REVISED AS REQ'D BASED ON THE COMPLETION OF A SOILS REPORT)

DETERMINE PRELIMINARY SLAB THICKNESS
  CHECK 2-WAY SHEAR)

$f'_c = 3000 \, psi$ 2'×2' PAD   ASSUME $h = 16''$ $d = 16'' - 3'' - \frac{1}{2}'' = 12.5''$

$V_c = \left(2 + \frac{4}{\beta_c}\right)\sqrt{f'_c}\, b_o d$ $\beta_c = \frac{b}{a} \geq 2$ $\beta_c = 1.0$ $b_o = (4)(2' + 12.5'') = 146''$

$$V_c = 4\sqrt{3000}\,(146'')(12.5'') = 400K$$

$$\phi V_c = .85(400K) = 340K \qquad \text{ALLOWABLE}.$$

FOR V_u: ASSUME 5'×5' TRIB AREA PER PAD
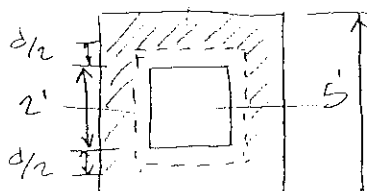
$$V_u = 1.244 \, ksf(1.7)\left[(5 \times 5') - [2' + 12.5'']^2\right] = 33.3K$$

OR $V_u = 70K(1.7) = 119K$

$\phi V_c > V_u$ OK USE 16'' THICK SLAB

Sheet 2 of 2

TANK FARM

MAT FOUNDATION DESIGN (CONT)

PRELIMINARY

DETERMINE REINF. IN MAT SLAB.

USE 5'-0" LONG × 1'-0" WIDE STRIP

$$M_u = \frac{1.244 \, ksf \, (1')(5)^2 (1.7)}{2} = 26.44 \, K \text{ FT/FT}$$

$$d = 12.5" \quad b = 12"$$

$$F = \frac{bd^2}{12000} = \frac{12(12.5)^2}{12000} = 0.156$$

$$k = \frac{26.44}{.156} = 169.5 \Rightarrow 170$$

$$\rho = 0.0030$$

$$A_{ST} = 0.003(12)(12.5) = 0.45 \, in^2/FT$$

USE #6 @ 12" O.C. $A_{qual} = 0.44 \, in^2/FT$

USE #6 @ 12" O.C. EA. WAY   TOP & BOTTOM

STRUCTURAL AND STRESS CALCULATIONS

LAB PACK STORAGE TANKS DESIGN

Acid Storage Tank - 5500 GAL

Caustic Storage Tank - 5500 GAL

$$\phi = 8 \, ft$$

$$A = \pi r^2$$

$$= \pi (4)^2$$

$$= 50.24 \, ft^2$$

$$V_{ft} = 50.24 \, ft^2 \times \frac{7.48 \, gal}{ft^3}$$

$$= 375.8 \, gal/ft$$

Required Height

$$H = \frac{5500 \, Gal}{375.8 \, gal/ft}$$

$$= 14.64 \, ft$$

Assume Dish Depth of $1\frac{1}{2}$ ft

(P) Pressure at bottom of vessel

Assume specific gravity = 2.0

Vessel ϕ = 8 ft

Vessel Straight Wall = 14 ft
Depth of Dish = 1½ ft

$P = (14' + 1.5')(2.0)(62.4 \ lbs/ft^3)$

$= 1934 \ lbs/ft^2$

$= 13.4 \ psi$

Per Pressure Vessel Handbook by Eugene Megyesy

Assume

(E) joint efficiency = 0.70

(S) design stress = 17,500 psi

(P) design pressure = 13.4 psi

(R) tank radius = 48 inches

(L) dish arc radius = 96 inches

for Cylindrical shell (Long Seam)

t_{wall} thickness required $= \dfrac{PR}{SE + 0.4P}$

$$= \dfrac{(13.4)(48)}{(17,500)(0.70) + 0.4(13.4)}$$

$$= 0.052 \text{ inches}$$

for Torispherical Head

when $L/r = 16\tfrac{2}{3}$

t_{wall} thickness required $= \dfrac{0.885\,PL}{SE + 0.8P}$

$$= \dfrac{0.885(13.4)(96)}{17,500(0.70) + 0.8(13.4)}$$

$$= 0.093 \text{ inches}$$

∴ for ¼" thick tank dish

0.25" − 0.093"

= 0.157 inches of material
available for erosion or
corrossion in the event of lining failure

LAB PACK STORAGE TANK CONCRETE DESIGN

5500 GAL ACID & CAUSTIC TANKS

Full Tank Weight

Max Specific Gravity = 2.0

$$W = 5500 \, GAL \times \frac{8.34 \, lb}{GAL} \times 2.0$$

$$= 91740 \, lbs$$

$$\underline{4600 \, lbs} \quad 5\% \text{ Tank Wt Allowance}$$

$$96,340 \, lbs$$

Each Tank has 4 Legs

$$Wt \text{ per Leg} = \frac{96,340 \, lbs}{4}$$

$$= 24,085 \, lbs$$

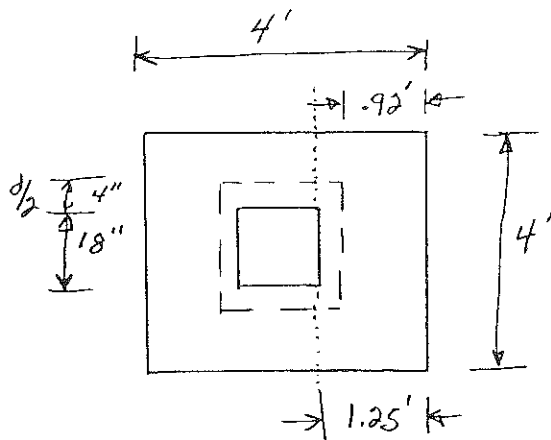Assume Allowable Bearing Capacity of 1500 psf

Required Footprint Per Leg

$$A = \frac{W}{1500 \, psf}$$

$$= \frac{24,085 \, lbs}{1500 \, psf}$$

$$= 16.05 \, ft^2$$

Assume 4' x 4' Footprint

Assume

Concrete thickness = 9"

No 5 rebar @ 12" c-c

rebar @ 5" from top

Concrete strength 3500 psi

Bending Moment in Slab Adjacent to Tank Foot Plate

$$M = (1500 psf)(1.25 ft)(4 ft)(1.25/2 ft)$$

$$= 4687 ft\text{-}\#$$

$$M_{ult} = 4687 ft\text{-}\# \times 1.7 \text{ (safety factor)}$$

$$= 7968 ft\text{-}\#$$

Rebar provided

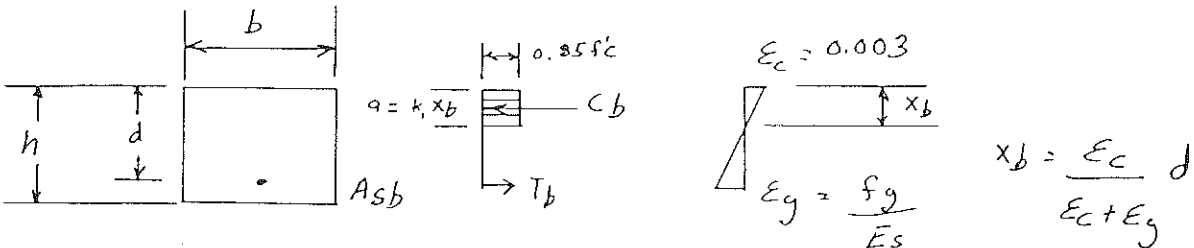$$\rho = \frac{As}{bd}$$

$$= \frac{(0.31 in^2)(4)}{(48 in)(5 in)}$$

$$= 0.005$$

$$0.005 < 0.027 \ (.75\rho_b) \quad OK \quad \text{See Sheet 3}$$

Concrete Design – Ultimate Strength Method

Given $f'_c = 3500\,psi$ $f_y = 60,000\,psi$ $k_1 = 0.85$ if $f'_c \leq 4000\,psi$

$$C_b = 0.85\,f'_c\,b\,k_1\,x_b$$

$$T_b = A_{sb}\,f_y = P_b\,bd\,f_y$$

$$C_b = T_b$$

$$= 0.85\,f'_c\,b\,k_1\left(\frac{87,000\,d}{87,000 + 60,000}\right)$$

$$= P_b\,bd\,f_y$$

$$\text{Balance Ratio } P_b = \frac{0.85\,f'_c\,k_1}{f_y}\left(\frac{87,000}{87,000 + f_y}\right)$$

$$= \frac{0.85\,(3500)(0.85)}{40,000}\left(\frac{87,000}{87,000 + 60,000}\right)$$

$$= 0.037$$

ACI code limits tension reinforcement to 75% of the balanced ratio

$$.75\,P_b = (.75)(0.037)$$

$$= 0.027$$

$\boxed{\text{Ultimate Strength Available}}$

$$T = A_s f_y$$

$$= \frac{0.31 in^2}{ft} \times 4 ft \times 60,000 psi$$

$$= 74,400 \ lbs$$

$$a = \frac{T}{0.85 \ f'_c \ b}$$

$$= \frac{74,400 \ lbs}{0.85 \ (3500 psi)(48 in)}$$

$$= 0.52$$

$$M'_u = \frac{T\left(d - \frac{a}{2}\right)}{12}$$

$$= \frac{74,400 \ lbs \left(5 - \frac{0.52}{2}\right)}{12}$$

$$= 14,694 \ ft-\#$$

M'_u available $>$ M_u required

$$14,694 \ ft-\# > 7968 \ ft-\# \quad OK$$

SIDEWALL AND BOTTOM STRUCTURE AND CORROSION CALCULATIONS

for Cylindrical Shell (Long Seam)

$$t_{wall\ thickness\ required} = \frac{PR}{SE + 0.4P}$$

$$= \frac{(13.9)(72)}{(17,500)(0.70) + 0.4(13.9)}$$

$$= 0.082\ inches$$

for Torispherical Head

when $L/r = 16\ 2/3$

$$t = \frac{0.885\ PL}{SE + 0.8P}$$

$$= \frac{0.885(13.9)(144)}{(17,500)(0.70) + 0.8(13.9)}$$

$$= 0.145\ inches$$

∴ for 1/4" thick tank wall

0.25" - 0.145"

= 0.105 inches of material
available for erosion or corrossion

Storage Vessel Design - TANK FARM

(P) Pressure at bottom of vessel

Assume specific gravity = 2.0

Vessel ϕ = 12 ft

Vessel straight wall = 14 ft

Height of Dish = 2 ft

$$P = (2.0)(14' + 2')(62.4\ lbs/ft^3)$$

$$= 1996\ lbs/ft^2$$

$$= 13.9\ psi$$

Per Pressure Vessel Handbook by Eugene Megyesy

Assume

(E) joint efficiency = 0.70

(S) design stress = 17,500 psi

(P) design pressure = 13.9 psi

(R) tank radius = 72 inches
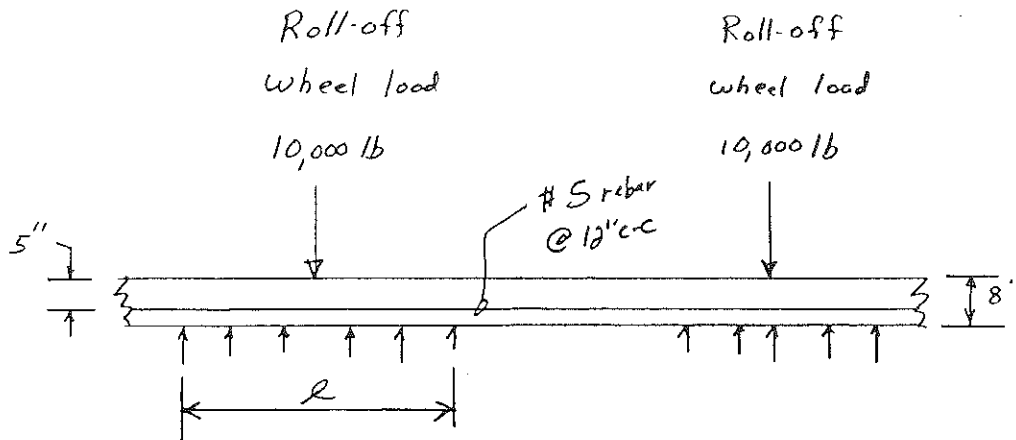
(L) dish arc radius = 144 inches

STRUCTURAL LOADING CALCULATIONS

Roll-off Area Concrete Design

Roll-off
Wheel load

10,000 lb

5 rebar
@ 12" c-c

Roll-off
wheel load

10,000 lb

5"   8"

ℓ

Assame

max Rolloff wheel load = 10,000 lb

Concrete thickness = 8 inch

No. 5 rebar @ 12" c-c   (0.31 in²)

Soil pressure capability = 1500 psf

Loading carried by 2 ft wide strip

$$10,000 \text{ lbs} = 2 \text{ ft } (\ell)(1500 \text{ psf})$$

$$\ell_{req'd} = 3.33 \text{ ft}$$

Max moment below wheel

$$m = (1500 \text{ psf})(2 \text{ ft})\left(\frac{3.33 \text{ ft}}{2}\right)\left(\frac{3.33 \text{ ft}}{4}\right)$$
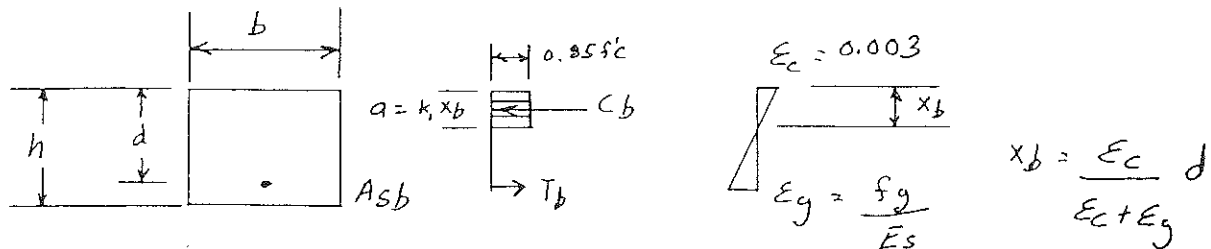
$$= 4158 \text{ ft -} \#$$

$$M_{ultimate} = 4158 \text{ ft-} \# \times 1.7 \text{ (Safety factor)}$$

$$= 7,068 \text{ ft -} \#$$

Concrete Design - Ultimate Strength Method

Given $f'_c = 3500 \, psi$ $f_y = 60,000 \, psi$ $k_1 = 0.85$ if $f'_c \leq 4000 psi$

$$C_b = 0.85 \, f'_c \, b \, k_1 \, x_b$$

$$T_b = A_{sb} \, f_y = \rho_b \, bd \, f_y$$

$$C_b = T_b$$

$$= 0.85 \, f'_c \, b \, k_1 \left(\frac{87,000 \, d}{87,000 + 60,000} \right)$$

$$= \rho_b \, bd \, f_y$$

Balance Ratio $\rho_b = \dfrac{0.85 \, f'_c \, k_1}{f_y} \left(\dfrac{87,000}{87,000 + f_y} \right)$

$$= \frac{0.85 \, (3500)(0.85)}{40,000} \left(\frac{87,000}{87,000 + 60,000} \right)$$

$$= 0.037$$

ACI code limits tension reinforcement to 75% of the balanced ratio

$$.75 \, \rho_b = (.75)(0.037)$$

$$= 0.027$$

Rebar provided

$$P = \frac{A_s}{bd}$$

$$= \frac{(0.31)(2)}{(24)(5)}$$

$$= 0.005$$

$$0.005 < 0.027 \quad (.75 P_b) \quad OK$$

Ultimate Strength Available

$$T = A_s f_y$$

$$= 0.31 \frac{in^2}{ft} \times 2f \times 60,000 psi$$

$$= 37,200 \; lbs$$

$$a = \frac{T}{0.85 \, f'_c \, b}$$

$$= \frac{37,200}{0.85 \, (3500)(24)}$$

$$= 0.52$$

$$m'_u = \frac{T \left(d - \frac{a}{2} \right)}{12}$$

$$= \frac{37,200 \; lbs \left(5 - \frac{0.52}{2} \right)}{12}$$

$$= 14,694 \; ft\text{-}\#$$

$$M'_u \; available \quad > \quad M_u \; required \qquad OK$$

$$14,694 \; ft\text{-}\# \quad > \quad 7,068 \; ft\text{-}\#$$

ATTACHMENT 17:   PHASED CONSTRUCTION REVISIONS

February 22, 1996

Mr. Pat Brady
Wisconsin Department of
Natural Resources
4041 North Richards Street
P.O. Box 12436
Milwaukee, Wisconsin 53212

RE: Feasibility Study and Plan of Operation Report
EOG Disposal, Inc. 5611 West Hemlock Street, Milwaukee, WI
EPA ID# WID988580056

Dear Mr. Brady,

Thank you for meeting with us regarding the changes we are requesting to make to the Feasibility Study/Plan of Operation Report (FPOR) submitted to the Wisconsin Department of Natural Resources on September 6, 1994. The following is a description of the additional operations we propose to implement before completion of the Phase II retrofit and completion of Phase IV.

These changes are to include a lab pack re-packaging and drum transfer/storage operation in the existing EOG Disposal, Inc. building during the Phase II Retrofit. The lab pack re-packaging operations will allow EOG the capability of re-packaging compatible laboratory chemicals from small containers into larger containers for off-site shipment to permitted Treatment Storage and Disposal Facilities. The transfer/storage operation will allow EOG to store drummed materials until truck load quantities can be sent off-site for Treatment or Recycling. These operations will take place during the Phase II Retrofit and will continue until the Lab pack Depack building is constructed and is operational.

EOG is committed to completing the construction of our hazardous waste management facility as outlined in the FPOR. The overall construction time table will depend on weather conditions and department approvals. The Lab Pack Depack building will be started as soon as the site preparation is completed so that the lab pack re-packaging operations can be moved into the new building. If conditions permit, Phase IV will be constructed in conjunction with Phase V.

The following is a revised construction schedule:

Phase I: Retrofit of the existing building that will include replacement of permeable curbing, installation of a surveillance and alarm system and sealing of floors for acceptance of all wastes with the exception of ignitables. This retrofit will begin March 15, 1996 and is expected to take 2 weeks.

Phase II: Remaining Retrofit of the existing building. Construction is expected to take 3 months.

Phase III: Site preparation will begin April 1, 1996 and is expected to take 4-5 months.

Phase IV: Construction of the Lab Pack Depack building will begin September 1, 1996 and is expected to take 4-5 months.

Phase V: Construction of the tank farm and roll-off container storage area will begin September 1, 1996 and is expected to take 4 months to construct.

Phase VI: Addition to the existing EOG Disposal building. Construction timetable has not been determined.

EOG will seek licensing for container storage after Phase I construction and a modification to this license for acceptance of ignitables after Phase II construction. License applications for the remaining phases will depend on construction completion dates. EOG will combine license applications when possible. For example, if the tank farm is completed at the same time as the Lab Pack Depack building, EOG will submit one tank license application for the tanks in the Lab Pack Depack Building and the tank farm.

EOG will be accepting Toxicity Characteristic wastes, hazardous wastes from non-specific sources, hazardous wastes from specific sources, various discarded commercial chemical products, off-specification materials, container residues, spill residues and various laboratory chemicals generated by EOG's existing and future clients. EOG will not accept any ignitable materials until the Phase II Retrofit has been completed.

The layout of the proposed lab pack storage and repackaging areas is illustrated in the attached Figure 1. EOG will set up five separate storage and repack areas that will have distinct boundaries and will be marked with yellow painted lines. The hazard class of the material in each storage/repack area will be clearly communicated by hazardous materials placards corresponding to the materials that are presently in that storage/repack area. The storage areas will be located on both the north side and the southwest corner of existing EOG Disposal building. In each storage/repack area the drums will be placed on spill containment pallets which will elevate the drums 6.5 inches off the floor and will provide enough room to hold either six or eight 55 gallon drums on its surface. The secondary containment capacity for the eight drum pallets is 82 gallons. The secondary containment capacity for the six drum pallets is 61 gallons.

As lab packs are received in 5, 10, 20 and 30 gallon containers they will be placed in appropriately designated storage/repack areas. They will then be depacked and repackaged in

to larger containers. All depacking will be done on top of the containment pallets. Containers in the lab packs will be combined with other containers in the lab packs without opening any of the containers. The contents of the containers in the lab packs will not be combined with any of the containers.

Bulk drummed materials received will be placed in appropriately designated storage areas to await transfer and shipment to permitted TSDFs.

The proposed operations will allow for storage of up to 468 hazardous waste containers and 280 non-hazardous waste containers or any combination of the above.

STORAGE/REPACK AREA 1: Is located along the north wall of the facility and measures 40 feet by 30 feet. It has enough area for 20 spill containment pallets (10 x 6 drum pallets and 10 x 8 drum pallets) holding a maximum of 140 x 55 gallon drums of material. This area will be used primarily for the storage and repackaging of hazard class 9 (other regulated materials) containers. The secondary containment for this storage area is 1,430 gallons.

STORAGE/REPACK AREA 2: Is located along the north wall adjacent to area 1 and measures 15 feet by 30 feet. It has enough area for 8 spill containment pallets (4 x 8 drum pallets and 4 x 6 drum pallets) holding a maximum of 56 x 55 gallon drums of material. This area will be used primarily for the storage and repackaging of reactive containers. The secondary containment for this area is 572 gallons.

STORAGE/REPACK AREA 3: Is located along the south wall of the facility opposite area 1 and measures 18 feet by 30 feet. It has enough area for 8 spill containment pallets (4 x 8 drum pallets and 4 x 6 drum pallets) holding a maximum of 56 x 55 gallon drums of material. This area will be used primarily for the storage and repackaging of corrosive bases (pH > 12.5) containers. The secondary containment for this area is 572 gallons.

STORAGE/REPACK AREA 4: Is located along the south wall of the facility and to the west adjacent to area 3. It measures 30 feet by 30 feet and has enough area for 16 spill containment pallets (8 x 8 drum pallets and 8 x 6 drum pallets) holding a maximum of 112 x 55 gallon drums of material. It will be used primarily for the storage and repackaging of poison containers. The secondary containment for this area is 1,144 gallons.

STORAGE/REPACK AREA 5: Is located in the southwest corner of the facility and measures 15 feet by 72 feet. It has enough area for 14 spill containment pallets (10 x 8 drum pallets and 4 x 6 drum pallets) holding a maximum of 104 x 55 gallon drums of material. It will be used primarily for the storage and repackaging of corrosive acid (pH < 2) containers. The secondary containment for this area is 1,064 gallons.

The above listed capacities all refer to 55 gallon drums. Pallets may actually contain drums of various sizes such as 5, 10, 20 and 30 gallon containers.

Depending on the quantities of various drums received, the hazard classes specified above for Storage/Repack areas may be interchanged. For instance, if EOG Disposal received 75 drums

of corrosive bases, area 1 may be designated for corrosive base storage and area 3 designated for hazard class 9 storage. Only chemicals that are compatible will be stored in each area. Common incompatibles which will not be stored together include acids with bases, acids with cyanides.

During the day to day operations spills of various materials may occur. The spill containment pallets are designed to prevent spilled materials from spreading throughout the storage/repack areas. In the event of a spill, steps will immediately be taken to clean up the spill and prevent the cross contamination of different wastes. The first step will be to identify the leaking container(s) and to stop the container from leaking the rest of its contents. Next, if there are any other containers on the same pallet as the leaking container they will be moved to another containment pallet in the same storage/repack area. The contents of the leaking drum will then be transferred to a proper container. Any spilled material that was contained in the pallet will also be transferred into this container. The containment pallet will then be decontaminated before it is used again.

The first step in the decontamination process is to soak up any remaining liquids that remain in the spill containment pallet with towels, pigs or other absorbents. The pallet grate and the containment area of the pallet will be washed with a solution of biodegradable degreasing cleaner and water using scrub brushes and rags to physically remove any residue left on the pallet or pallet grate. The pallet grate and the containment area of the pallet will then be triple rinsed with a dilute solution of cleaner and water a total of three times. The resultant contaminated cleaning solution, rinsate, rags and absorbents will be collected into drums and disposed of at a fully permitted TSDF.

After the completion of the Phase II Retrofit and approval of this modification, EOG will be accepting ignitables. Storage Area 1 will be designated as ignitable storage. Precautions taken in the container storage area to prevent accidental fire and explosion include the proper storage of containers (stacking, aisle space, labeling and sealing of containers) dikes and warning signs. Smoking is prohibited. To prevent sources of external ignition, explosion proof electrical equipment will be used in all ignitable liquids storage areas.

Containers holding ignitable waste are stored 50 feet from the property line.

Open flames are prohibited in areas where ignitable wastes are handled.

All containers are compatible to the material stored in them. Incompatible materials are separated and stored in designated areas.

In addition to the storage/repack areas there will also be a supply area for containers, vermiculite and pallets. This will be in the area marked supplies on figure 1. This is the area currently utilized for supply storage and currently ocuppied by the laboratory. The laboratory walls will be taken down and all equipment will be moved into the area marked as the office.

The additional drum storage illustrated on figure 1 will be utilized for non-hazardous drummed materials. Lab packs will only be placed in designated storage areas 1-5.

It is EOG's policy to manage these wastes in the most cost effective way possible, making sure that no backlog of wastes is stored on-site for extended periods of time.

Completion of the Phase II Retrofit will continue during the lab pack re-packaging and drum transfer/storage operations. Worker safety will be of the utmost importance. Lab Pack re-packaging and transfer/storage operations will not take place while construction workers are working on the retrofit.

During the lab pack re-packaging operations, EOG will adhere to all of the relevant procedures described in the Feasibility and Plan of Operation Report (FPOR). The following is a listing of each of the FPOR Attachments and their related procedures:

Prior to acceptance, a Waste Profile Sheet and lab pack drum inventory for lab packs and waste streams will be completed by the generator or broker and forwarded to the Approvals Coordinator for review as described in Attachment 5, WASTE ANALYSIS PLAN, Section 2 of the FPOR.

Waste Streams will be sampled and analyzed per the requirements of Attachment 5, WASTE ANALYSIS PLAN, Section 4. Shipment Screening will be completed per the requirements of Attachment 5, WASTE ANALYSIS PLAN, Section 5. EOG will follow the Sampling Procedures described in Attachment 5, WASTE ANALYSIS PLAN, Section 7.

EOG will follow the Rejection Procedures as described in Attachment 5, WASTE ANALYSIS PLAN, Section 6.

During the lab pack depack and storage/transfer operations appropriate components of the Inspection Schedule, described in Attachment 6, of the FPOR will be phased into normal operating procedures.

EOG will follow the Operation and Maintenance Procedure described in Attachment 7, PROCESS INFORMATION, Section 2.7.

EOG will follow the Aisle Spacing Requirements described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 5.

EOG will follow the Service Arrangements described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 6.

Loading and off-loading operations will be followed as described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 7.

EOG will follow Preventative and Remedial Actions procedures as described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 8.2 and 8.4.

EOG will follow the Runoff Prevention Procedures described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 9.1.

EOG will follow the Employee Exposure Prevention procedures described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 10.

EOG will follow the Groundwater Contamination Prevention procedures described in Attachment 8, PREPAREDNESS AND PREVENTION PLAN, Section 11.

EOG will follow all of the relevant procedures described in Attachment 8, SPILL PREVENTION CONTROL AND COUNTERMEASURE.

EOG will follow all of the procedures described in Attachment 9, CONTINGENCY PLAN.
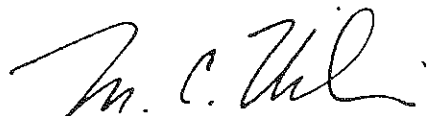
EOG will follow all of the relevant procedures described in Attachment 11, CLOSURE PLAN.

Closure costs for the proposed lab pack re-packaging and drum transfer/storage operations are estimated to total $128,212.70. These costs are illustrated in the attached Table 1 and Table 2. The recycling/disposal costs listed in these tables are based on an inventory of 60% lab packs and 40% hazardous waste drums. When the lab pack re-packaging operations are moved to the Lab Pack Depack building, the spill containment pallets will continue to be used for operations in the existing EOG Disposal building. Any contaminated spill containment pallets will be decontaminated prior to reuse. The decontamination calculation for the spill containment pallets of $715 shown in Table 1 and Table 2 is based on decontaminating 20% of the 66 pallets at $55 each.

EOG Disposal currently has an insurance policy for closure in the amount of $151,503.00 and proposes to continue this policy in its current dollar amount. When Phase IV and Phase V are permitted, the closure amount will be revised to reflect Table 4 in Attachment 11, CLOSURE PLAN, of the FPOR.

We look forward to your comments regarding these proposed changes. If you have any questions regarding this request please contact me.

Sincerely,
EOG Disposal, Incorporated

Michael C. Vilione, President
VK Investments (Owner)

cc: Ed Lynch
      Tom McElligott

STAGING
AREA

AREA 5

AREA 4

AREA 3

AREA 1

TABLE 1

CLOSURE COST ESTIMATE

Closure Activities	Unit Cost	Quantity	Total ($)
Recycling/Disposal of Hazardous Waste Drum Inventory	non-responsive	187	$24,310.00
Recycling/Disposal of Lab-Pack Drum Inventory		281	$56,200.00
Transportation Costs		6	$1,800.00
Storage Areas -decontaminate floor surfaces -rinsate analyses -decontaminate containment pallets		1 6 13	$5,250.00 $6,282.00 $715.00
Closure-Derived Waste Management - solid residues - liquid residues		2,500 15,000	$2,500.00 $7,500.00
Engineering - closure observation - documentation report		5 1	$6,000.00 $6,000.00
10% Contingency		1	$11,584.20
TOTAL			$127,426.20

TABLE 2

CLOSURE COST ESTIMATE

Closure Activities	Hazardous Waste Storage Closure Cost Estimate[1]	Nonhazardous Waste Storage Closure Cost Estimate[2]
Recycling/Disposal of Inventory	$80,510.00	$16,600.00 [3]
Transportation Costs	$1,800.00	
Storage Areas - decontaminate floor surfaces - rinsate analyses -decontaminate spill containment pallets	$5,250.00 $6,282.00 $715.00	NR NR NR
Closure-Derived Waste Management - solid residues - liquid residues	$2,500.00 $7,500.00	NR NR
Engineering - closure observation activities - documentation report	$6,000.00 $6,000.00	NR NR
10% Contingency	$11,655.70	$1,660
TOTAL	$128,212.70	$18,260.00

NOTES:
1   Based on Closure Plan Cost Estimate (see TABLE 1).
2   Based on non-responsive for disposal and transportation costs.
3   Included in disposal of inventory unit cost.

Slab Shear Calculations

2 Way Shear

$$V_u = P_{net}\ (area) = 1.5\ [(4)(4) - (1.08)(1.08)]$$

$$= 22.25\ Kips$$

$$v_u = \frac{V_u}{bd} = \frac{22,250}{4(18+8)(8)}$$

$$= 26\ psi$$

Allowable $v_{uc} = 4\ \phi\ \sqrt{f'c}$

$$= 4\ (0.85)\ \sqrt{3500}$$

$$= 201\ psi\ > 26\ psi\ OK$$

1 Way Shear

$$V_u = 1.5\ (0.92')(4.0')$$

$$= 5.52\ Kips$$

$$v_u = \frac{V_u}{bd} = \frac{5,520}{(4)(12)(8)}$$

$$= 14.4\ psi$$

Allow $v_{uc} = 2\ \phi\ \sqrt{f'c}$

$$= 2\ (0.85)\ \sqrt{3500}$$

$$= 100.5\ psi\ > 14.4\ psi\ OK$$

ATTACHMENT 18: LICENSING CORRESPONDENCE

NOTICE OF INCOMPLETENESS RESPONSE DATED FEBRUARY 27, 1995

NOTICE OF INCOMPLETENESS RESPONSE DATED APRIL 21, 1995

NOTICE OF COMPLETENESS & PRELIMINARY DETERMINATION RESPONSE DATED NOVEMBER 19, 1995

FEASIBILITY AND PLAN OF OPERATION DETERMINATION DATED APRIL 19, 1996

February 27, 1995

Mr. Pat Brady
Wisconsin Department of
  Natural Resources
4041 North Richards Street
P.O. Box 12436
Milwaukee, WI 53212

RE: Feasibility Report and Plan of Operation
       Notice of Incompleteness Response for Non-Design Related Issues
       EOG Disposal, Inc. (EOG) 5611 West Hemlock, Milwaukee, WI
       EPA I.D.#: WID 988580056

Dear Mr. Brady,

On behalf of EOG Disposal, Inc., RMT has prepared a response to your letter of incompleteness dated
December 9, 1994 for EOG's September 1994 FRPO submittal. Your letter addressed both points of
completeness and points of adequacy.
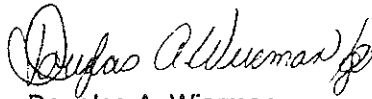
As requested in your letter, EOG has submitted the following information as replacement pages
and/or additional pages to the original document. All replacement pages and additional pages have
been marked as such and include the date of this response submittal.

This response has been prepared on a point by point basis from the December 9, 1994 Notice of
Incompleteness letter for ease of review. As discussed during our January 3, 1995 meeting with you,
EOG has responded only to the non-design related issues of incompleteness and inadequacy at this
time.

We trust this information is sufficient for your review. We look forward to WDNR's issuance of EOG's
operation license.

Sincerely,

RMT, Inc.

Douglas A. Wierman
Project Manager

cc: Mike Vilione
       Henry Krier
       Tom McElligott
       Ed Lynch

GENERAL CONCERNS

Comment #1:   **Throughout the FRPO flammable is used interchangeably with ignitable. The hazardous waste regulations apply to ignitable wastes not flammable wastes. EOG shall change any inappropriate uses of flammable in the FRPO.**

EOG Response #1:   *EOG has changed all inappropriate uses of flammable in the FRPO. Attachments 2 through 11 contain the pages of the FRPO have been corrected.*

Comment #2:   **EOG should not reference the federal code unless the state has not promulgated comparable regulations. EOG shall change any inappropriate references to the federal code in the FRPO.**

EOG Response #2:   *EOG has removed all references to the federal code which the state has promulgated comparable regulations in the FRPO. Attachments 2 through 11 contain the pages of the FRPO have been corrected.*

Comment #3:   **EOG shall provide information to answer whether s. 144.44(4R), Wisconsin Statutes, applies to their facility. In order to determine applicability, EOG shall provide adequate information to demonstrate whether or not this statute applies.**

EOG Response #3:   Section 144.44(4r), Wisconsin Statutes refers to noncompliance with plans or orders. This does not apply because EOG is in compliance with the terms of their solid waste permit and interim status permit for hazardous waste storage which were approved by the department. In accordance with ss. 144.443, Wisconsin Statutes, EOG has provided proof of financial responsibility ensuring the availability of funds to comply with the above mentioned plans to the department. EOG has no interest in any other solid or hazardous waste facilities in Wisconsin.

Comment #4:   **EOG shall provide information on the other tenants residing in the Megal Corporation building.**

EOG Response #4:   *Tenants currently residing in the Megal Corporation building include:*

Design Specialties (Manufacture fireplace doors)
5609 W. Hemlock Street
Milwaukee, WI 53223
(414) 353-4339

ARKO (Dog Training School)
5605 W. Hemlock Street
Milwaukee, WI 53223
(414) 353-4768

Comment #5:   EOG speaks of exempt recycling activities and reclamation operations in the FRPO. The department would like to see EOG present specific information on each of these processes. EOG should receive concurrence from the department that their recycling activities are exempt activities and not treatment. (attachment 7, section 1, page 5, paragraph 3)

EOG Response #5:   The blending tank will be constructed in accordance with the requirements of WAC NR 645. Information on the blending tank will be submitted under a separate submittal. EOG will keep track of all waste codes blended by use of a waste code tally sheet (see Attachment 13 of this submittal) and all blended materials will carry all waste codes which were mixed, stored and transported off site (see EOG Response # 24 for further information on waste code tracking). If non-hazardous materials are blended with hazardous materials, the blended material will be managed as a hazardous material.

Comment #6:   If some of the operations at the facility that were thought to be recycling should be actually regulated as treatment, EOG shall update the FRPO to reflect licensed treatment activities. ss. NR 640.06(3), and NR 645.06(3), Wisconsin Administrative Code.

EOG Response #6:   All operations proposed at the EOG facility are strictly recycling operations and no treatment operations will occur.

Comment #7:   EOG shall provide more specific information on the liquification process at the facility including what is liquified.

EOG Response #7:   The "liquification process" refers to the dispersement of viscous materials. For example, a heavy ink will disperse when mixed with a solvent. Viscous materials such as paints, resins and inks will be transferred to one of the fuel blending tanks via a conveyor system. When mixed with the solvent in the tank, the solids will disperse or "liquify".

Comment #8:   EOG shall explain what is done with the solvents recovered from the vapor recovery unit.

EOG Response #8:   EOG will be fuel blending recovered solvents from the vapor recovery unit. The condensed vapor will be pumped to one of the blended fuel storage tanks.

This information is outlined in the original application in Attachment 7, Section 2.3.2, page 12 of the September 1994 submittal.

Comment #9:   Attachment 7, section 2.5, page 14, references drum pumping stations. EOG shall provide more information on these drum pumping stations, including at a minimum where the drum pumping stations would be located throughout the site and a description of the associated piping.

EOG Response #9:   *EOG will utilize air motor or explosion-proof electric motor driven drum pumps within the curbed area containing the fuel blending tank to transfer "water-like" low viscosity liquids into the fuel blending tank. The piping will consist of flexible hose attached directly to the drum pump within the containment area. The flexible hose will be connected to schedule 40 steel pipe for the remaining 5-to-10 feet distance to the fuel blending tank. Text has been revised in Attachment 7, Section 2.5, page 14. Attachment 7 of this submittal contains the revised page.*

Comment #10:   EOG shall provide more specific information on the blending tank. This information shall include the types of waste that are blended, (hazardous characteristic waste oils, solvents, listed hazardous waste, etc.), what wastes are blended with what other wastes, what wastes are never blended together, and whether the wastes are shipped off site as hazardous wastes. If hazardous wastes are blended in the tank and the wastes from the tank are sent off site as a hazardous waste, the department would apply the same requirements for a hazardous waste storage tank to the blending tank. If this is the case EOG shall show how the blending tank complies with the requirements for a hazardous waste storage tank and submit the same information that would be required for licensing that tank.

EOG Response #10:   *The fuel blending tank proposed to be utilized at the facility is intended to blend hazardous characteristic waste oils and solvents as well as hazardous waste solids with a fuel value of 5,000 BTU per pound. This blending will create a pumpable fuel that will contain solids of not greater than 0.25-inch diameter with a pH range within 2 units and 12.5 units. EOG will not blend reactives, PCB's, oxidizers, strong acids or strong bases with the waste fuel mixture. The blended fuel will be transferred to the storage tanks for off-site shipment. The blending tank will be constructed as a hazardous waste storage tank in accordance with the requirements of WAC NR 645. Information on the blending tank will be submitted under a separate submittal.*

Comment #11:   Attachment 7, Section 2.3, page 10, paragraph 4, references, "a suitable blended condition." EOG shall provide a clearer explanation of what is "a suitable blended condition."

EOG Response #11:   *The "suitable blended condition" refers to a mixture of fuel that meets the specifications/requirements of the end user as per their permits and waste analysis plan. EOG has incorporated into the text of Attachment 7, Section 2.2.3, page 10, paragraph 2, the meaning of "a suitable blended condition." The corrected pages which address this issue is contained in Attachment 7 of this submittal.*

Comment #12:   **EOG shall provide a clearer explanation of the drum auger operation at the site. This information shall at a minimum include; a plan sheet of the auger operation, whether both solid and hazardous waste will be processed in the auger, whether solids from the auger would be treated as a solid or a hazardous waste (attachment 7, section 2.2, page 9), how solids will be transferred from the solids auger (whether the solids will be pumped), and the decision making process used to determine where the solids will be transferred.**

EOG Response #12:   *Additional text and completed plan sheets showing drum auger operation in greater detail will be submitted by EOG under a separate submittal.*

Comment #13:   **EOG shall provide more information on containment in all of the loading and unloading areas. This information shall include specifications. EOG shall also explain how dock #2 is designed to contain precipitation. (attachment 7, page 8)**

EOG Response #13:   EOG will utilize containment ramps and curbs of concrete with epoxy mortar construction as well as containment trenches. The sentence contained in Attachment 7, Section 2.1.2, page 8, paragraph 1 states "The dock is constructed of concrete, and is designed to contain any precipitation" is incomplete and should read "The dock is constructed of concrete, and is designed to contain any potential spillage inside the building from mixing with any precipitation." This would be accomplished by means of the containment ramp to be constructed at the dock entrance. The containment ramps to be constructed at each dock entrance will be constructed of minimum 5,000 PSIG compressive strength concrete doweled into the existing concrete floor by means of #4 rebar spaced on a minimum 24-inch centers. The concrete will be topped by an epoxy grout mixture with a minimum compressive strength of 6,000 PSIG that can be "feathered" to match the existing concrete and provide a smooth transition for the truck traffic over the ramp. The final surface will be the seamless epoxy floor surfacing material to be applied on and contiguous with the floor of the building. Text has been revised in Attachment 7, Section 2.1.2, page 8. Attachment 7 of this submittal contains the revised page.

GENERAL REPORT REQUIREMENTS (ch. NR 680, Wisconsin Administrative Code)

Comment #14: EOG shall submit plan sheets showing site construction and operation topography. These plans should show how final construction will fit into the existing landscape. This should include cross sections, and construction specifications which show foundations of the facility structures. s . NR 680.05(1)(c)4.f., Wisconsin Administrative Code.

EOG Response #14: Additional text and completed plan sheets showing site construction and operation topography will be submitted by EOG under a separate submittal.

Comment #15: EOG shall submit a signed copy of the proposed Part A application. s. NR 680.06(3)(a), Wisconsin Administrative Code.

EOG Response #15: Attachment 1 of this submittal contains a signed copy of the Part A application.

Comment #16: EOG shall submit a Part A application for the existing facility that contains the even number pages. s. NR 680.06(3)(a), Wisconsin Administrative Code.

EOG Response #16: Attachment 1 of this submittal contains all pages of the Part A application for the existing facility.

Comment #17: EOG shall provide a chemical and physical analysis of the hazardous waste to be handled at the facility. At a minimum, these analyses shall contain all of the information which must be known to store the waste in accordance with chs. NR 600 through 685, Wisconsin Administrative Code. s. NR 680.06(3)(b), Wisconsin Administrative Code.

EOG Response #17: EOG will conduct analysis of six indicator parameters to determine the acceptability of waste materials, compatibility, BTU's/pound, chloride content, water content, pH, and specific gravity.

Comment #18: Attachment 3, appendix E, section 1.1, page 3, refers to the recent extension of RCRA regulations to now include small quantity generators. EOG shall provide a further explanation of what is meant by that statement. s. NR 680.06(6), Wisconsin Administrative Code.

EOG Response #18: Most waste management companies do not have the capabilities to handle small quantities of materials. EOG has specialized in dealing with materials from small quantity generators, we have carved out a 'niche' in the industry to manage the 1-5 drum quantities of small quantity generators. The text of Attachment 3, Appendix E, Section 1.1, page 3 has been changed to clarify this statement. Attachment 4 of this submittal contains the revised page.

Comment #19:   EOG shall provide information on any other statutory authority or local,
                 state or federal approvals that apply to the facility. s. NR 680.06(6)(a)2.,
                 Wisconsin Administrative Code.

EOG Response #19:   No other statutory authority, local, state or federal approvals apply to EOG.

Comment #20:   EOG Shall provide information on any emissions or discharges associated
                 with preparation and construction of the facility. s. NR 680.06(6)(a)4.,
                 Wisconsin Administrative Code.

EOG Response #20:   Emissions related to construction equipment will be controlled as appropriate
                    during preparation and construction activities. EOG will also set up temporary
                    silt fences to prevent sediment runoff during preparation and construction of
                    the facility. EOG has incorporated this text into Attachment 3, Appendix E,
                    Section 2.4. These replacement pages are contained in Attachment 4 of this
                    submittal.

Comment #21:   I could not find information on other anticipate changes with facility
                 development. The checklist points out that the information should be in
                 attachment 3, appendix D, section 6. Even assuming appendix E, (see
                 condition #95), I could not locate the information. EOG shall provide such
                 information or point out where such information is located in the FRPO. s.
                 NR 680.06(6)(a)5., Wisconsin Administrative Code.

EOG Response #21:   No other changes associated with the facilities operations are anticipated other
                    than those stated in this application. EOG has incorporated this text into
                    Attachment 3, Appendix E, Section 2.5. These replacement pages are
                    contained in Attachment 4 of this submittal.

Comment #22:   Attachment 2, section 3, page 2, states, "No other permitted facilities in
                 geographic proximity to EOG would offer the diversity of hazardous waste
                 recycling nor the distribution of service." EOG shall explain what they
                 consider to be in the geographic proximity to EOG. EOG shall also explain
                 in more detail their, "diversity of hazardous waste recycling," and their,
                 "distribution of service." In attachment 2, section 5, page 2, EOG states
                 that their, "service area extends throughout the United States." EOG shall
                 discuss in further detail a breakdown of their service area and how their
                 other branch offices work with the Milwaukee facility. s. NR 680.06(8),
                 Wisconsin Administrative Code.

EOG Response #22:   EOG is a full service waste consulting firm located in Milwaukee, Wisconsin
                    with branch offices in Westmont, Illinois, Minneapolis, Minnesota, Salt lake City,
                    Utah and College Station, Texas. The Milwaukee facility is EOG's only
                    processing facility. Each of these offices has an Account Manager that is
                    responsible for sales within that specific region. These sales offices will be

directing drums from their clients to EOG's Milwaukee facility for processing.
EOG has added text to Attachment 2, Section 3, page 2 to clarify this issue.
Attachment 2 of this submittal contain the revised page.

WASTE ANALYSIS PLAN (ss. NR 680.06(3)(c), AND nr 630.13(1) Wisconsin Administrative Code)

Comment #23: EOG shall explain the criteria for blending of wastes. EOG shall also explain what will be done to ensure that only compatible wastes are blended. EOG shall present a clearer more concrete description of how incompatible wastes and reactive wastes are determined and separated.

EOG Response #23: To ensure that only compatible wastes are processed and blended, a composite sample of each inbound waste stream to the EOG facility will be subject to compatibility testing (see Attachment 15 of this submittal). If the material is compatible, it will be deemed acceptable for waste-derived-fuel production. If a waste stream material is deemed incompatible, it will not be processed or blended into a waste-derived-fuel.

Comment #24: Much of hazardous wastes shipped today can have multiple waste codes. EOG shall explain how wastes received at their site with multiple waste codes will be processed through their system and whether they anticipate any problems will occur. EOG shall explain if any waste codes will be lost through the consolidation or processing of the waste.

EOG Response #24 All materials accepted by EOG will be accompanied by a manifest that will have waste codes listed in sections I and J. These waste codes will be transferred onto a tally sheet (see Attachment 12 of this submittal) as the materials are blended. These tally sheets will accompany outgoing manifests. Waste codes are also listed on the "EOG BULK MATERIALS INVENTORY REPORT" located in Attachment 6, Appendix C. The tally sheets and Bulk Materials Inventory report will be filled out manually and the data will then be entered into our computerized inventory control system. This will enable us to track waste codes for all incoming and outgoing waste streams. No waste codes will be lost in the blending of waste streams and waste codes will be carried through all the way to the end-sites.

Comment #25: EOG shall explain who fills out a waste profile sheet and whether the form is always completely filled out.

EOG Response #25: Waste profile sheets are to be filled out by the generator or broker. Waste Profile forms accepted by EOG will include EOG's Waste Profile Sheet (WPS), the generators waste identification form, or one of the waste identification forms used by brokers who represent the generator. The Waste Profile form is always completed; however, if some areas of the form are incomplete when submitted,

EOG will contact the generator and/or broker to gather the information necessary to fully complete the form. EOG has added text to Attachment 5, Section 2, page 2 to clarify this issue. Attachment 5 of this submittal contain the revised pages.

Comment #26: **EOG shall explain what are the minimum requirements that are required on a generator's or broker's waste identification form.**

EOG Response #26: *The waste identification form will at a minimum contain Generator Information, Waste Description, General Characteristics, RCRA Information, Viscosity, Total Suspended Solids, pH, BTU's, Flash Point, Halogens, Hazardous Characteristics and Other Components, Chemical Composition and Metals information. EOG has added text to Attachment 5, Section 2, page 2 to clarify this issue. Attachment 5 of this submittal contain the revised pages.*

Comment #27: **EOG explains that, "pre-qualification samples are periodically requested for verification and generators shall be requested to periodically resubmit waste identification forms." EOG shall explain what is meant by "periodically." The department would like to see a consistent system in place.**

EOG Response #27: *Annual recertification of each active waste stream by each generator will be required to document any changes in the nature of the waste. This will encompass completion of a Waste Profile Sheet and a sample if changes to the waste stream or process generating the waste stream are apparent.*

Comment #28: **EOG's use of the descriptor with the table of the list of wastes to be managed on site looks good. The department would like to see EOG add an additional descriptor which would be whether the waste will be sent offsite for use as a secondary fuel.**

EOG Response #28: *A descriptor which indicates which materials will be sent off site for use as a secondary fuel has been added to Attachment 5, page 35 and the contents of this table have been updated. Attachment 5 of this submittal contains Table 1 with the new descriptor added.*

Comment #29: **EOG shall clearly define what is involved in the precertification process. (attachment 3, section 4, page 31)**

EOG Response #29: *Attachment 5, Section 4, page 36, the first sentence has been changed to read as follows: "Generally, any material that has been approved through the pre-qualification process, consisting of Waste Profile evaluation and sample analysis if required, is initially acceptable." Attachment 5 of this submittal contains the revised page for this issue.*

Comment #30:   Attachment 3, section 4, page 31, mentions that, "the materials may be analyzed for the following parameters in an onsite laboratory to determine their acceptability based on the schedule presented in Section 8, Analysis Plan." EOG shall explain whether materials will always be analyzed based on the schedule.

EOG Response #30:   EOG will analyze for all the parameters listed in Attachment 5, Section 4, page 36 in an on-site laboratory to determine the acceptability based on the schedule presented in Attachment 5, Section 8. Attachment 5 of this submittal contains the revised page.

Comment #31:   Attachment 3, section 7.3, page 37,mentions, "sampling bulk load solids may be done by taking random samples throughout the load." EOG shall explain whether bulk load solids will always be sampled.

EOG Response #31:   EOG will sample bulk solid loads by taking samples throughout the load to make a representative composite sample. Attachment 5 of this submittal contains the revised page.

Comment #32:   Attachment 3, section 5.1, page 32,talks about the receipt of containerized loads. EOG shall rewrite this section so that it is clear what tests are done, when and where the tests are done, and on what wastes the tests are done. The department needs to know how often the waste is sampled.

EOG Response #32:   Containers from each generators waste stream(s) shall also be randomly chosen for analysis and inspection. A minimum of ten percent of the containers of each generators waste stream(s) shall be sampled and analyzed for compatibility, BTU/pound, chloride, water, specific gravity and pH in the on-site laboratory. This same analysis shall be performed for bulk loads. All incoming wastes are sampled. Attachment 5 of this submittal contains the revised pages.

Comment #33:   Attachment 3, section 5.1, page 32, mentions that, "containers shall also be randomly chosen for analysis and inspection." EOG shall explain more clearly how this choosing of containers is done.

EOG Response #33:   A minimum of ten percent of each generator's waste stream(s) shall be sampled and analyzed in the on-site laboratory. Attachment 5 of this submittal contains the revised pages.

Comment #34:   Attachment 8, Spill Prevention Control and Countermeasures Plan, figure 1, Flow Diagram, page 18, contains a very well done and useful flow chart. The department feels it would be a benefit to also include this flow chart in the waste analysis plan and add the analysis done at each stage for waste

received from offsite and include the type of analysis.

EOG Response #34:   *An updated flow diagram has been prepared to include the analysis done at each stage for waste received from off site as well as the type of analysis performed. This flow chart has been added to the Waste Analysis Plan of the permit application. Attachment 5, Appendix C of this submittal contains the updated flow diagram.*

Comment #35:   **Attachment 3, section 5.2 and section 5.3, page 33, both mention, "and any other analysis as deemed necessary by management." EOG shall discuss what other analyses would be performed and when would they be deemed necessary.**

EOG Response #35:   Additional analysis may be necessary on suspect materials to verify that the parameters of the shipped waste reasonably match the parameters provided on the Waste Profile Sheet (WPS) for that waste. Examples of suspected materials and tests performed for verification include the following:

- Reactive testing on methacrylates

- Odor or viscosity to verify with the WPS

- Additional analysis may be necessary such as ash content for end-site disposal approval.

Comment #36:   **EOG shall explain if any analysis is performed on lab packs. EOG shall also explain whether the contents of the lab packs will be emptied and combined with like materials. If EOG plans to combine the contents of the lab packs, the department feels that some type of compatibility testing will need to be performed. (attachment 3, section 5.4, page 34)**

EOG Response #36:   *The contents of the lab packs will be de-packed. The lab packs will then undergo one of the following:*

- *consolidated and blended to produce a waste-derived fuel,*

- *repacked with other compatible chemicals, or;*

- *consolidated into the acid or basic storage tanks.*

Lab packs not suitable for consolidation will be repacked with compatible chemicals. All other lab packs will undergo testing for compatibility once they have been depacked. For lab packs consolidated for fuel blending, the same six parameters identified in EOG Response #30 will be analyzed per composite waste stream.

Comment #37: After EOG signs off on the manifest, they are unable to send the waste back to the generator unless the generator is a licensed facility able to receive waste from offsite. EOG shall include a statement in the waste analysis plan that reflects this issue. (attachment 3, section 6, page 35)

EOG Response #37: *If a full load of material is rejected, the manifest will not be signed by EOG. If a partial load of containerized material is rejected, the containers will be noted in section 19 of the manifest and then the manifest will be signed by EOG to certify receipt of non-rejected containers. Text has been inserted in Attachment 5, Section 6, page 40 to clarify this issue. Attachment 5 of this submittal contains the revised page.*

Comment #38: EOG shall explain how they could reject only a part of a bulk load. (attachment 3, section 6.2, page 5)

EOG Response #38: *EOG expects that bulk waste may be delivered in compartmentalized trailers. In this case EOG can reject a part of a bulk load. Text has been added to Attachment 5, Section 6.2, page 5 to clarify this issue. Attachment 5 of this submittal contains the revised page.*

Comment # 39: Attachment 3, section 6.4, page 36, concerns the rejection procedures for polychlorinated biphenyl loads. If PCB's are received at the site in units other than lab packs, EOG shall change the wording to reflect the use of other units.

EOG Response #39: *EOG has changed the wording of Attachment 5, Section 6.4, page 41, sentence 1 to reflect PCB's being received at the site in units (i.e., capacitors, ballasts, etc.) other than lab packs. Attachment 5 of this submittal contains the revised page.*

Comment #40: EOG shall explain what products are produced at the facility. (attachment 3, section 11, page 61)

EOG Response #40 *Products produced at the EOG facility will consist of "usable fuel products". EOG has changed the wording in Attachment 5, Section 11, page 66 to better describe the products produced at EOG's facility. Attachment 5 of this submittal contains the revised page.*

Comment #41: In attachment 3, table 2, pages 39 through 58, EOG shall list what are each of the "other" tests.

EOG Response #41: *EOG has revised Table 2 of Attachment 5 to include the analysis performed for all wastes having waste codes received at EOG. Attachment 5 of this submittal contains the revised Table 2.*

Comment #42:   EOG shall explain whether the analyses listed in attachment 3, table 2, pages 39 through 58 are the only analyses performed on the waste and when these analyses would be performed on the waste.

EOG Response #42:   *The analysis listed on revised Table 2 of Attachment 5 will be completed on each waste stream when it arrives at the EOG facility.*

Comment #43:   EOG shall explain who will be performing the waste analysis.

EOG Response #43:   *Once samples are collected and labeled, they will be brought to the on-site laboratory for analysis which will be completed by the Laboratory Chemist. Attachment 5, Section 7.1, page 42 has been changed to clarify this issue. Attachment 5 of this submittal contains the revised page.*

Comment #44:   EOG shall state that the chemical and physical samples will be analyzed by a laboratory certified or registered under ch. NR 149, Wisconsin Administrative Code, as required by ss. NR 630.13(2) and (4), Wisconsin Administrative Code.

EOG Response #44:   *Chemical and physical samples will be analyzed for waste characterization by a laboratory certified or registered under ch. 149, Wisconsin Administrative Code. Section 4 of Attachment 5 contains the revised page.*

CONTAINER REQUIREMENTS (ch. NR 640, Wisconsin Administrative Code. Tank Requirements, (ch. NR 645, Wisconsin Administrative Code), included if they also apply)

Comment #45:   The FRPO mentions "these drawings" in attachment 7, section 2.4, page 13, paragraph 4. EOG shall provide more specific information on what "these drawings" are and where they are located.

EOG Response #45:   *Attachment 7, Section 2.4, page 13, text has been revised to indicate that Sheets 9, 10 and 11 of Attachment 15 depict the typical locations of containers within the storage/process building for storage of up to 2,272 containers, however, the number of containers in any of these areas may vary. Attachment 7 of this submittal contains the revised page.*

Comment #46:   I understand EOG is located on two separately owned properties. EOG shall clearly explain the division of the two properties, clearly identify the two property owners, explain how this division of the two properties will be handled for the operation of this site, and explain what problems would be anticipated in having two separate property owners and how those problems would be addressed. EOG shall explain how the second property owner will be kept informed of activities going on at the site. ss. NR 640.06(1)(a)2., and 645.06(1)(a)2., Wisconsin Administrative Code.

EOG Response #46:   EOG has added the new lease agreement between EOG and Megal
                     Development Corp as Appendix F to Attachment 3. EOG has purchased the
                     property and has entered a lease agreement with Megal Development Corp. for
                     office space adjacent to the property. Attachment 16 of this submittal contains
                     the lease agreement.

Comment #47:   **EOG shall include in the FRPO whether any parks, hospitals, or nursing
                     homes are within a 1/2 mile radius of the facility. s. NR 640.06(1)(a)3.,
                     Wisconsin Administrative Code.**

EOG Response #47:   No nursing homes or hospitals are located within a 1/2 mile radius of the EOG
                     facility. There are two country clubs; to the west, approximately 810 feet from
                     the EOG facility is Brynwood Country Club and to the east, approximately 1350
                     feet from the EOG facility is Tripoli Golf Club no other parks or recreational
                     areas are known to exist within a 1/2 mile radius of the EOG facility. Sheet 6 of
                     18 of the September 1994 FRPO submittal shows the location of these country
                     clubs in relation to the EOG facility. Text has been added to Attachment 3,
                     Section 2.2, to satisfy WAC NR 640.06(1)(a)3. Attachment 3 of this submittal
                     contains the revised pages.

Comment #48:   **EOG lists facilities from all over the country from which they would be
                     accepting waste. EOG shall explain whether these wastes would be going
                     to the Milwaukee site or one of their other sites. ss. NR 640.06(1)(a)4.,
                     and NR 645.06(1)(a)4., Wisconsin Administrative Code.**

EOG Response #48:   As noted in EOG Response #22, EOG is a full service waste consulting firm
                     located in Milwaukee, Wisconsin with branch offices in Westmont, Illinois,
                     Minneapolis, Minnesota, Salt lake City, Utah and College Station, Texas. The
                     Milwaukee facility is EOG's only processing facility. Each of these offices has
                     an Account Manager that is responsible for sales within that specific region.
                     These _sales offices_ will be directing drums from their clients to EOG's
                     Milwaukee facility for processing. EOG has added text to Attachment 2,
                     Section 3, page 2 to clarify this issue. Attachment 2 of this submittal contains
                     the revised page.

Comment #49:   **EOG shall provide a response to the material balance informational request
                     of ss. NR 640.06(1)(a)5. and 7., and NR 645.06(1)(a)5. and 7., Wisconsin
                     Administrative Code, or explain where this information is located in the
                     FRPO. I could not locate this information in attachment 3, section 7.**

EOG Response #49:   No wastes will be generated at EOG,s facility. Waste accepted at EOG's facility
                     will be bulked and/or blended for use in secondary markets (i.e., cement kilns)
                     Examples of material balance at this facility are as follows:

Scenario 1
EOG receives a lab pack containing the following chemicals:

Sulfuric Acid	*1 pint*	*D002*
Phosphoric Acid	*1/2 gallon*	*D002*
Hydrochloric Acid	*1 quart*	*D002*
Nitric Acid Solution 40 %	*1 quart*	*D002*
Chromic Acid Solution	*4 oz.*	*D002, D007*
Hydrofluoric Acid	*1 pint*	*D002*

All of these items will be depacked and consolidated into the acid tank. Any items that are received in a lab pack that could not be bulked would be repacked and sent to an off-site disposal facility for disposal. The containers would be triple rinsed with the rinse water going into the acid tank. The glass jars would then be crushed and sent to a glass reclaimer.

Scenario 2
EOG receives 55-gallon drums of acetone from an industrial client which carries the EPA waste codes D001 and F003. These drums are pumped into one of the bulk fuel tanks. When the materials from this tank ships off-site, the manifest will carry the D001 and F003 codes as well as any other codes from material bulked into this tank. The RCRA empty drums will be sent off-site to a drum reclaimer.

Scenario 3
EOG receives a lab pack containing the following chemicals:

Acetone	*1 pint*	*D001, F003*
Hexane	*1 quart*	*D001, F005*
Toluene	*1 pint*	*D001, F005*
Allyl Alcohol	*2x1 pint*	*D001, P005*
Hexachlorobenzene	*1/2 pound*	*U127, D032*
Methylene Chloride	*1 quart*	*F002*
Phenol	*1 pound*	*U188*
Methyl Ethyl Ketone	*1/2 gallon*	*D001, F005, D035*
Methanol	*2x1 quart*	*D001, F003*
Pyridine	*1 pint*	*D001, F003, D038*

All of these items will be depacked and consolidated for fuel. All of the waste codes will be retained through the bulking process. When the materials ship off-site, the manifest will carry all waste codes. The containers would be triple rinsed with the rinse water going into the fuel. The glass jars would then be crushed and sent to a glass reclaimer. Attachment 3, Section 7.1 contains the revised page(s).

Comment #50:   17. The area north of the Megal Corporation building is where traffic will enter the site and access to the site will be controlled. EOG shall provide a clearer description of the area north of the Megal Corporation building. ss. NR 640.06(1)(a)6., NR 640.06(1)(c)6., NR 645.06(1)(a)6., and NR 645.06(1)(c)6., Wisconsin Administrative Code. EOG shall also explain where trucks will be parked when they are waiting to enter the EOG property while multiple loads are being delivered to EOG. ss. NR 640.06(1)(h)4., and NR 645.06(1)(h)4., Wisconsin Administrative Code.

EOG Response #50:   *For the expanded facility, waste delivery trucks enter the facility through the main gate located north (rear) of the leased office space. The area north of the lease office space is a paved roadway and parking area. This parking lot area is rarely used by the tenants of the building because sufficient parking space is available in the front of the building. Trucks waiting to enter the facility while multiple loads are being delivered, will park along the northern boundary of the paved roadway. Text has been added to Attachment 3, Section 5. Attachment 3 of this submittal contains the revised page.*

Comment #51:   **EOG shall identify the persons or person responsible for plant construction. ss. NR 640.06(1)(a)8., and NR 645.06(1)(a)8., Wisconsin Administrative Code.**

EOG Response #51:   *Henry Krier of EOG will be the primary person responsible for site construction. Megal Corporation will also be involved with the site construction activities. Text has been added to Attachment 3, Section 8 to clarify this issue. Attachment 3 of this submittal contains the revised page.*

Comment #52:   **EOG shall explain whether an air management permit will be needed for the site. EOG shall present more specific information on air emissions than what is in attachment 3, Section 10.1. ss. NR 640.06(1)(a)9., and NR 645.06(1)(a)9., Wisconsin Administrative Code.**

EOG Response #52:   *Text has been added to Section 10.1 of Attachment 3. EOG requires a construction air permit and an operating air permit for the site. The construction air permit as a new, non part 70 source (minor source) has been prepared. The construction permit has been submitted to the Wisconsin Department of Natural Resources, and copies have been forwarded to you for your use as Exhibit 1 of this submittal.*

Comment #53:   **EOG shall provide further information on the facility layout including building and structures foundation, sizing of receiving areas, sizing of major processes and processing equipment. ss. NR 640.06(1)(a)12., and NR 645.06(1)(a)12., Wisconsin Administrative Code.**

EOG Response #53:   *Additional text and completed plan sheets of building and structures*

*foundations, sizing of receiving areas, sizing of major processes and process
equipment in greater detail will be submitted by EOG under a separate
submittal.*

Comment #54:   **EOG shall explain the timing of the construction of the new site. EOG
explains that the facility will be constructed in a phased approach. The
department would like the specifics of the plan because the phased
construction might affect the coordination of the licensing at the facility.
EOG shall provide a time table for start up and operation of the various
units at the site. ss. NR 640.06(1)(a)13., and NR 645.13(1)(a)13.,
Wisconsin Administrative Code.**

EOG Response #54:   *EOG will complete their facility construction in the following phases:*

> *Phase I:*   *Retrofit the existing building at 5611 West Hemlock
> Street to meet permit requirements for storage of
> hazardous wastes.*
>
> *Phase II:*   *Construction of the Lab Pack Depack building.*
>
> *Phase III:*   *Construction of the tank farm.*

*All necessary security and safety issues associated with each Phase will be self
contained. For example, the facility fence and security system will be
constructed during Phase I. The facility construction Phases have been added
to Attachment 3, Section 8. Attachment 3 of this submittal contains the revised
pages.*

Comment #55:   **EOG shall explain what provisions will be taken during the construction of
the facility to ensure protection of groundwater and surface waters. ss. NR
640.06(1)(a)15., and NR 645.06(1)(a)15., Wisconsin Administrative Code.**

EOG Response #55:   *Additional text and completed plan sheets explaining the provisions that will be
taken during construction will be submitted by EOG under a separate submittal.*

Comment #56:   **In addition to identifying the surrounding businesses, EOG shall identify
the surrounding property owners., ss. NR 640.06(1)(b)7., and NR
645.06(1)(b)7., Wisconsin Administrative Code.**

EOG Response #56:   *The surrounding property owners consist of the following:*

> •   *5606 W. Hemlock Street (north)
> Megal Development Corp.
> P.O. Box 18661
> Milwaukee, WI 53218*

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